DIESEL PROGRESS

IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR

SEPTEMBER, 1940 CIRCULATION OF THIS ISSUE—IN EXCESS OF 14,000 COPIES 25c

DIESEL PROGRESS and DIESEL AVIATION

REX W. WADMAN
Editor and Publisher

FRONT COVER ILLUSTRATION: Mr. G. Peabody Gardner's new 65 ft. auxiliary yawl "Rose," designed by John G. Alden and built by the Quincy Adams Yacht Yard. The "Rose" is powered with a three cylinder, 82 hp. Gray Marine Diesel.

TABLE OF CONTENTS ILLUSTRATION: Typical illustration of how Diesel-equipped Caterpillar road building equipment is economically and efficiently building new highways from one end of this big country to the other.

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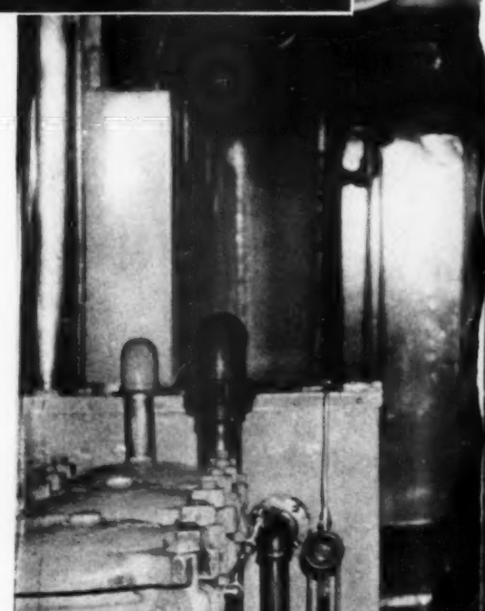
SEPTEMBER CONTENTS



Exterior and two interior views of the re-powered Rock Island Rail Car. Showing the two Hamilton 400 hp. Diesels installed in same space formerly occupied by the gasoline engines.

ROCK ISLAND DIESEL RAIL CAR

By DWIGHT ROBISON

ON January 31, 1940, the Rock Island Railroad put in service Motor Car No. 9007 equipped with two Hamilton 400 hp. 4-cycle Diesel engines. This installation was watched with considerable interest by a great number of railroad men because the Diesel engines replaced the gasoline engines which were originally installed in the car using the same electrical equipment. The Rock Island Railroad changed from gasoline to Diesel operation on this car because the original engines needed extensive repairs and because of the savings which could be effected by the use of fuel oil driven units. Since that time, this car has made 50,000 revenue miles with only 15 minutes delay due to engine and installation trouble. This fine record of performance was accompanied with a saving of approximately 11c per revenue mile over the operation of similar gas electric units operating in the same territory and on the same schedules.

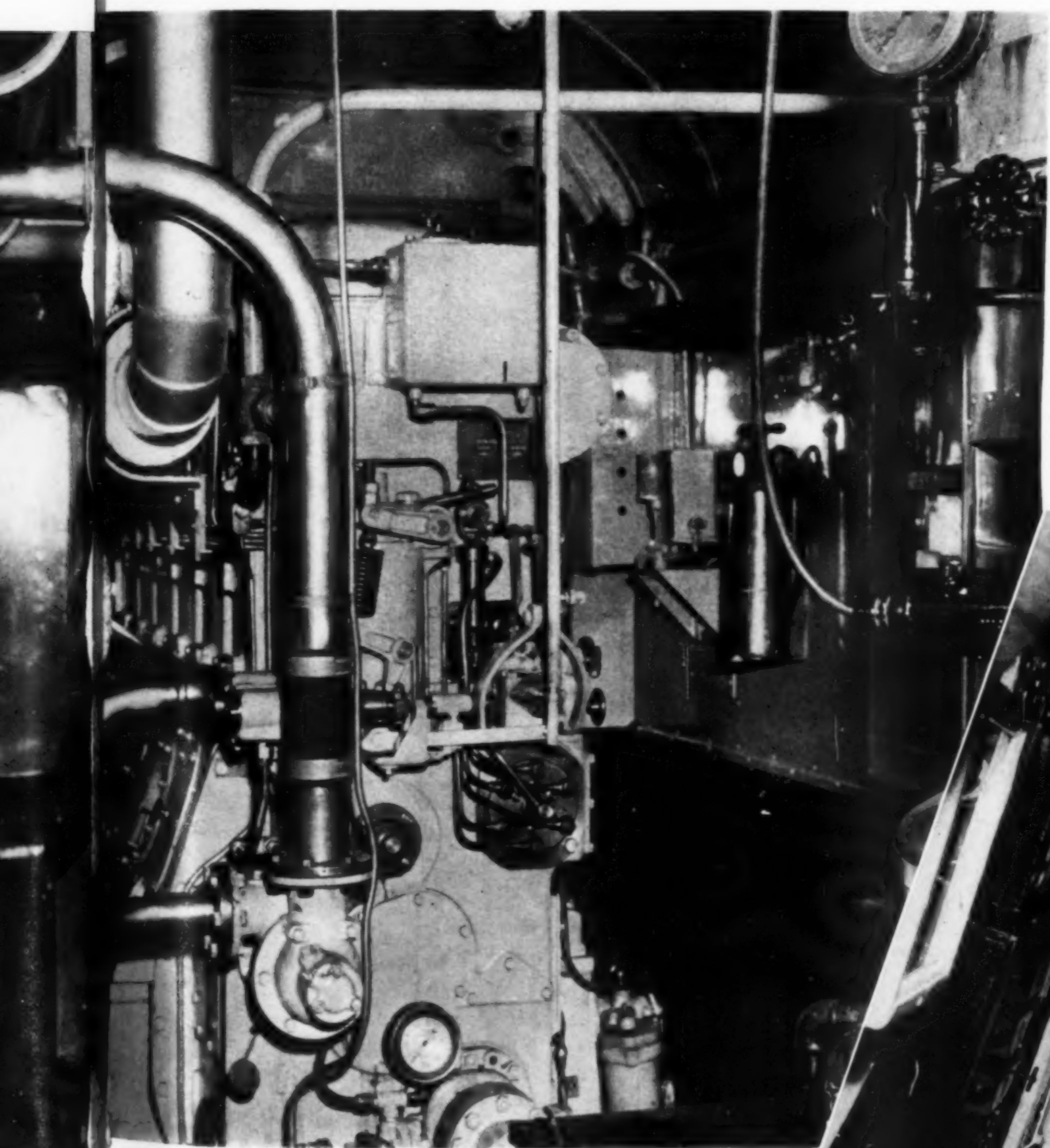
The Hamilton 4-cycle Diesel engines are lighter in weight than the gasoline engines replaced, fit into exactly the same space and operate at the same rpm. making them completely interchangeable with the gasoline engines which were originally supplied. These

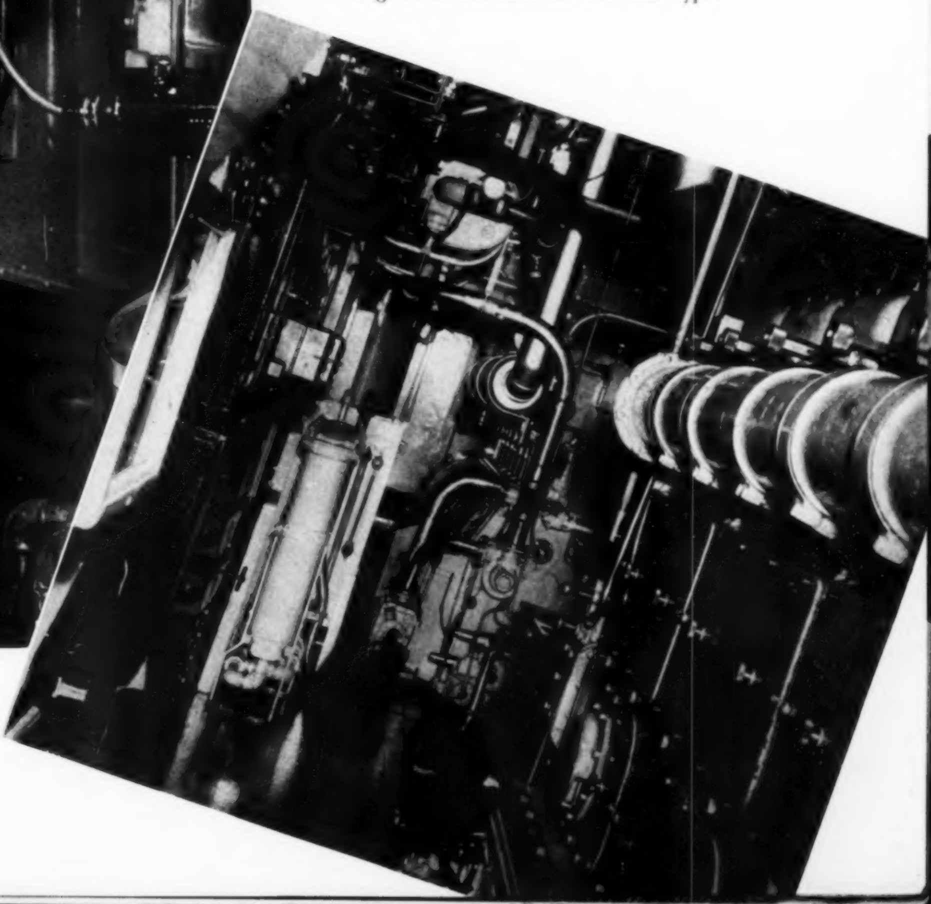
Diesel engines were specially developed for this type of work and are extremely rugged and simple. They were designed with the idea in mind of building an engine with all parts accessible and with as simplified construction as possible. Some of the major features are tie rod construction, dry joint between liner and cylinder head, dual intake and exhaust valves, force feed lubrication throughout, simple flyball type governor mounted on the forward end of the engine, precision bearings, two piece connecting rods, and double seal liner joints. All of the auxiliary pump drives are located on the forward end of the engine and can be easily removed. The flywheel is machined to fit the original coupling supplied and the throttle control can be connected to the original throttle stand. Due to the fact that the engines develop the same hp. at the same speed as the gasoline engines, no electrical alterations were required.

Very few changes were necessary in the engine room. Due to the fact that the existing piping had been in service for about 10 years, all new water and oil circulating piping was installed. This piping was made of copper tubing to eliminate the necessity of using flexible connections between the engines and radiators, filters and tanks. The heating boiler fuel tank was removed and the boiler operates on the same fuel used in the engines. Fuel filters and lubricating oil coolers are mounted on the engine sub-base and the lube oil filters are mounted against the existing lube oil tanks. The lube oil coolers are removed from the roof of the car and the engine jacket circulating water system was changed so that the lube oil cooler was inserted in the water circulating system between the engine water pump and engine water jackets. In order to increase the life of the storage batteries, the Diesel engines are started with 250# compressed air supplied by a 7 cu. ft. gasoline engine driven air compressor. The weight of this unit in operating condition with the gasoline engines installed was 105 tons and after the Diesel installation was made, the weight was reduced to 102½ tons. This saving in weight was effected by removing the boiler fuel tank and by the lower weight of the Diesels, compared to the gasoline engines.

This unit has now been in operation for 50,000 miles during which time both extremes of weather conditions have been encountered, during the winter this unit is operated from Rock Island to Sioux Falls, South Dakota, and during the summer between Memphis, Tennessee, and Little Rock, Arkansas. The radiation provided for the gasoline engines has proven ample for the Diesel engine installation and maximum circulating water temperature reached in summer has not exceeded 180° while the lube oil temperature has never exceeded 170°. This unit has a total of 800 horsepower and has maintained a 36 mile an hour schedule pulling a standard six-axle baggage car, a standard six-axle coach, and two standard Pullman sleepers. On flat runs a maximum speed of 67 miles per hour has been reached pulling a standard baggage car and two coaches.

During the month of March this unit was operated on one side of the Rock Island, Sioux Falls run, while the other side was maintained by a similar car equipped with gasoline engines. The total mileage for the month was 12,000 miles per car. The saving in operating expense of the Diesel engines over the gasoline engines in fuel and lubricating oil was 10.8c per mile, or a saving of $1296 per month. Since this unit has shown such gratifying results the Rock Island Lines are installing Hamilton 4-cycle engines in all their units of this type.





This complete, self-contained Diesel generating unit is used by R. E. A. for emergency service on its lines and during development of new projects.

MOBILE GENERATING PLANTS

FOR JO-CARROLL ELECTRIC COOPERATIVE, INC.

THE ever-progressive R. E. A. has again taken the initiative in utilizing Diesel economy and availability. Its most recent application of Diesels is in mobile generating units which are required for temporary service on new projects.

Frequently, R. E. A. is unable to secure immediate service from existing power lines at reasonable prices or under satisfactory conditions. Furthermore, it has been found desirable to use mobile plants on new projects for the period of a year or so, during which time the capacity of the ultimate plant can be determined or conditions of purchase from existing lines can be arranged.

The two mobile units on the Jo-Carroll Electric Cooperative project in Illinois were purchased from the General Motors Corporation. Each plant consists of two units: one 60 kw. and one 40 kw., with a 3 panel switchboard consisting mostly of Weston instruments and Allis-Chalmers circuit breaker and Westinghouse graphic voltmeter. The generators supplied with the engines were made by the Delco Products Company. The plant also has Delco-Remy battery charging generators and starting motors.

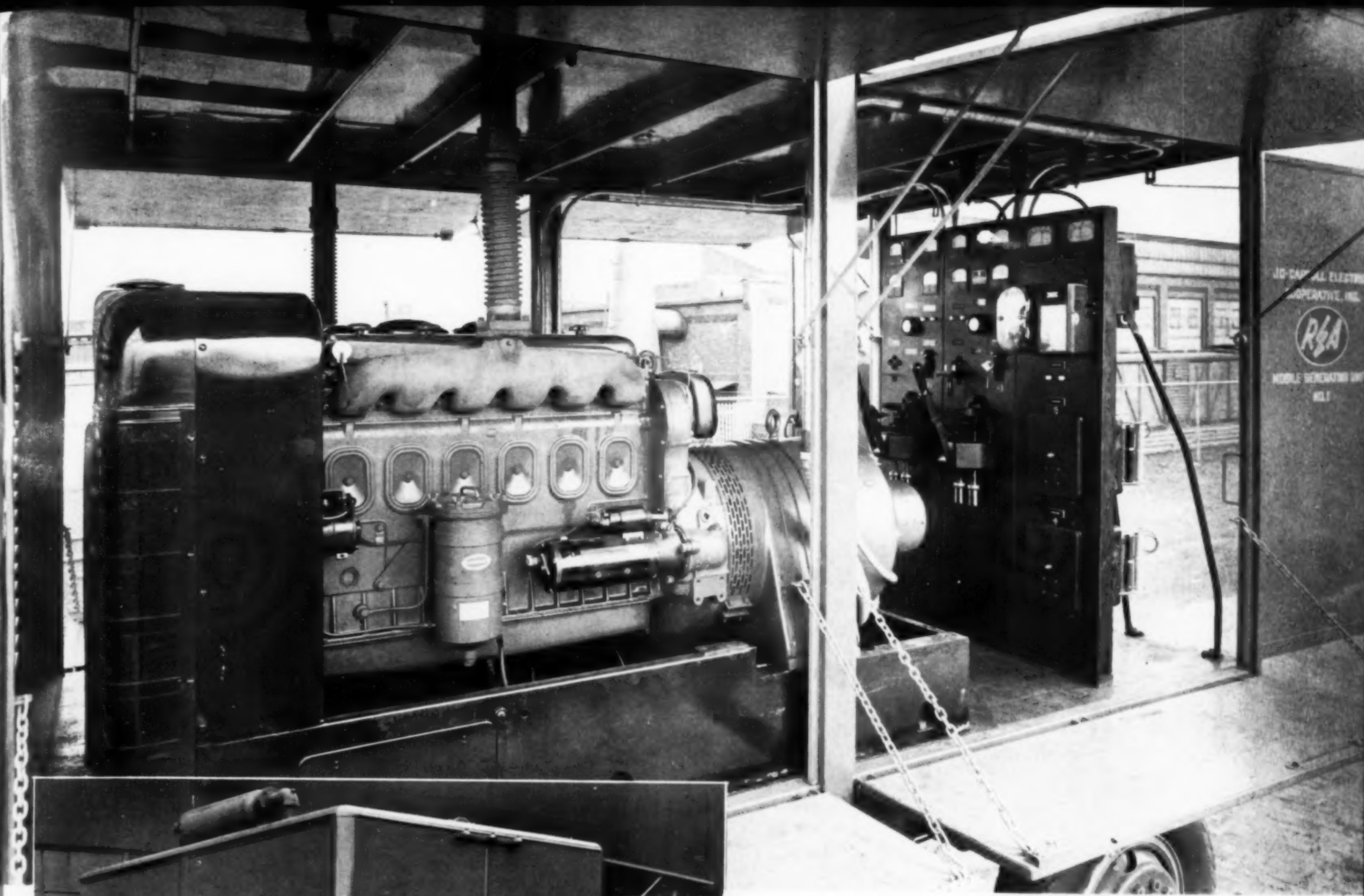
Each engine is equipped with a Full Flow fuel filter manufactured by the Commercial Filters Corporation, and a Skinner purifier for lubricating oil, and A.C. air filters. The engines are also equipped with Pierce overspeed trip governors and Kysor alarm thermostats. The plants are mounted as shown in the photographs on 4-wheel pneumatic tire trailers, equipped with air brakes, signal lights, etc.

Generators are 440 volt, 3 phase, alternating current, 60 cycles.

The plant is directly connected to the distribution lines through transformers mounted on poles, stepping up from 440 to 7200 volts, which is the normal R. E. A. line voltage.

Future plants will be mounted on dual wheel trailers and will also have 3 phase step-up transformers mounted on the rear of the trailers so that all it will be necessary to do to connect up to the lines will be to move the trailers into place and hook them up to the lines. The necessary circuit breakers and disconnect switches are also mounted on the trailer, making a complete generating unit.

R. E. A. has just purchased five more plants



Each mobile plant consists of two Diesel generating units with all accessories required for independent operation. ↑

The plant may be closed up and operated automatically for periods up to sixteen hours. ←

each consisting of two 50 kw. Ready-Power Company units, direct-connected to International Harvester Company engines and three more plants of General Motors manufacture, each consisting of two 60 kw. units.

The cost of these plants is very reasonable, being approximately $125 a kilowatt, with all of the overhead charges added, ready for operation, and it appears that some of the future plants will be even less than this, so that the interest and amortization charges will not be heavy. And the plants are equipped with sufficient automatic gadgets to enable operation of the plant with very little labor.

In fact, it is expected that the plants will be shut up, running automatically, at least sixteen hours a day. Under these conditions, and with a normal expectancy of load, the cost of power should not be excessive. The efficiency of the machines is very little lower than Diesels of larger size.

The engines are full Diesel, and have all the characteristics of larger R. E. A. Diesel power plants. Very little water is required as they are equipped, as you will note, with radiators similar to automobiles and an occasional bucket of water is needed for makeup purposes.

Regulation is stipulated at $3\frac{1}{2}\%$, which is sufficiently good for any of the rural requirements. The fact of the matter is, the mobile units will have few heavy loads to contend with, and the regulation will probably come well within the $3\frac{1}{2}\%$ limit.

R. E. A. selected Diesels for these mobile plants because of their ability to perform continuously and independently in out-of-the-way places. While the basic requirements of these self-contained plants were specified, the design details were left up to the manufacturers and the results have been both satisfactory and interesting. It is hoped that the experience gained from the use of these mobile generating plants will be a valuable feature in the National Defense Program.

One of the numerous twin-engined long-range fighter-bombers powered with Junkers Jumo 205 Diesels which the German Air Force is holding in reserve for special missions.

DIESEL-ENGINED WARPLANES ARE NEEDED FOR OUR NATIONAL DEFENCE

***By* PAUL H. WILKINSON**

THE rearmament program upon which the United States has now embarked undoubtedly is the greatest in our history. Casting precedent aside, the government has called to Washington some of the leading aviation authorities and production men in the country to help outline this vast program. So far, the government has allocated hundreds of millions of dollars for aviation equipment including large sums of money for gasoline aircraft engines. But it is yet to be seen what provision—if any—is being made for the development and production of Diesel aircraft engines comparable to those in use and under development in Germany.

Recently, the writer paid a visit to Washington to ascertain the attitude of various government departments to our need for high-powered Diesel aircraft engines. There it was found that the Bureau of Aeronautics had two Diesel projects under way which had been passed on to it some years ago by the Army Air Corps. In the writer's opinion, the flight-testing and small series production of the Guiberson and Godfrey Diesels comprising these Navy projects will not be attainable before 1942. The Army Air Corps, on the other hand, admitted that it was not doing any Diesel development and did not even have a Diesel expert on its staff. Apparently the policy of the Army Air Corps is to wait and see what success the Bureau of Aeronautics has with its Diesel development. Among the civil experts called in to advise the government on aviation matters, none of them had seen the production of modern high-powered Diesel aircraft engines recently in Germany nor had they flown in a Diesel-engined warplane.

In Washington, the question was asked: "Why do we need Diesel-engined warplanes?" A glance at the photographs accompanying this article supplies the answer. Right now, Germany has thousands of these fast, up-to-date, Diesel-engined fighter-bombers in commission ready for long-range operations at a moment's notice. *By way of contrast, we do not have even one Diesel-engined warplane nor the engines for them in the United States.*

The Junkers Ju 86-K twin-engined fighter-bombers shown in the first two photographs are typical of the up-to-date equipment of the tremendously powerful unified air force in Germany. These warplanes with their non-explosive fuel oil are practically fireproof and immune to electrical interference. Due to their low fuel consumption they have a considerably longer flight range than gasoline-engined warplanes of comparative power. They are also adaptable with regard to the fuel they use and can be flown on kerosene in an emergency. When 100 of these Diesel-engined warplanes are in operation there is a saving of 5 tons each hour in the weight of fuel required for the group compared with the weight of fuel required for 100 gasoline-engined warplanes of equal power.

The question naturally arises: "If these Diesel-engined warplanes are so efficient, why hasn't Germany used them in the European war?" The answer to this is that Germany has built these long-range fighter-bombers for a *specific purpose* and is keeping them in reserve until the right time comes to use them. Military strategists doubtless will agree that the same question could have been asked a year ago concerning the 70-ton Diesel-engined tanks which Germany had in commission but had not then used in warfare. No one will deny the effectiveness of these tanks, however, when the time comes to use them for the purposes for which they were intended.

No excuse can be offered for our unpreparedness in Diesel aviation in the United States. The success of this type of power plant in Germany has been publicized for the past 5 years in DIESEL PROGRESS which is widely circulated in Washington. Up to the end of June of this year the writer had contributed 57 articles to this magazine comprising 134 pages of material and 243 photographs and drawings calling attention to the subject. Numerous other writings have been contributed by him to magazines and newspapers, and a revised edition of his book, DIESEL AIRCRAFT ENGINES, is ready for publication.

Much of our unpreparedness with regard to the Diesel aircraft engine in the United States can be attributed to selfish opposition to a new type of power plant. Such opposition, of course, is to be expected against any new and superior process or device by those who previously have enjoyed a monopoly. One of the favorite arguments advanced against the Diesel has been that Germany has taken the Diesels out of her warplanes and has replaced them with gasoline engines. Knowing German efficiency, is it not

ridiculous to assume that after installing special machinery for mass production and building thousands of Diesels, Germany would relegate to the scrap heap engines representing an investment of many millions of dollars?

Now that our National Defence is being subjected to close scrutiny, it is evident that neglect of the Diesel aircraft engine has considerably weakened our air defences. Propaganda to the effect that we do not need these up-to-date power plants has lulled the United States into a sense of false security. Opposition has delayed the proper development of suitable Diesel aircraft engines to such an extent that now it is very difficult for us to catch up with Germany. Although the Diesel situation is bad, it can still be rectified if the government brushes aside needless opposition and old-fashioned ideas and tackles the problem in a whole-hearted and intelligent manner.

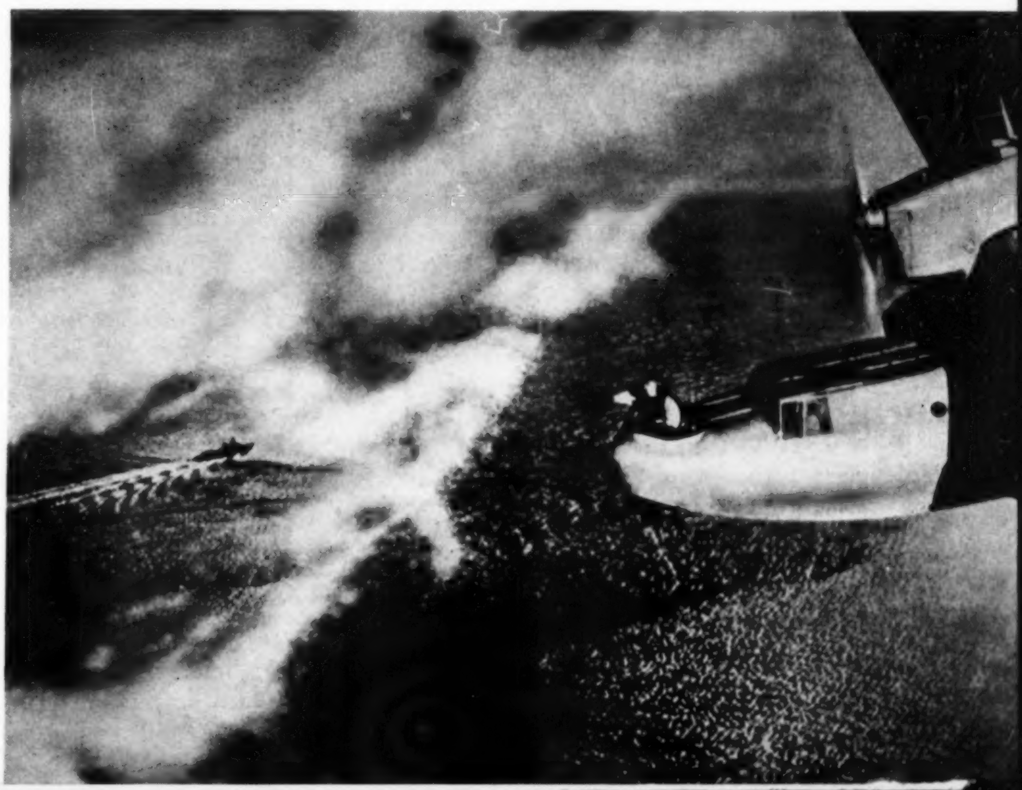
What we now need in the United States is a carefully prepared program for the development and production of high-powered Diesel aircraft engines comparable in performance to those being produced in Germany. This program should preferably be a joint one for both the Bureau of Aeronautics and the Army Air Corps and should be planned and directed by the leading authorities in the country on this type of power plant. Placing Diesel aircraft engine development under the control of an aircraft power plant division which devotes practically all of its time to gasoline aircraft engines as has been done by the Bureau of Aeronautics, is far from satisfactory. *Our backwardness in Diesel aircraft engine development now demands 100 per cent activity and enthusiastic cooperation on the part of the government to make up for this inertia.*

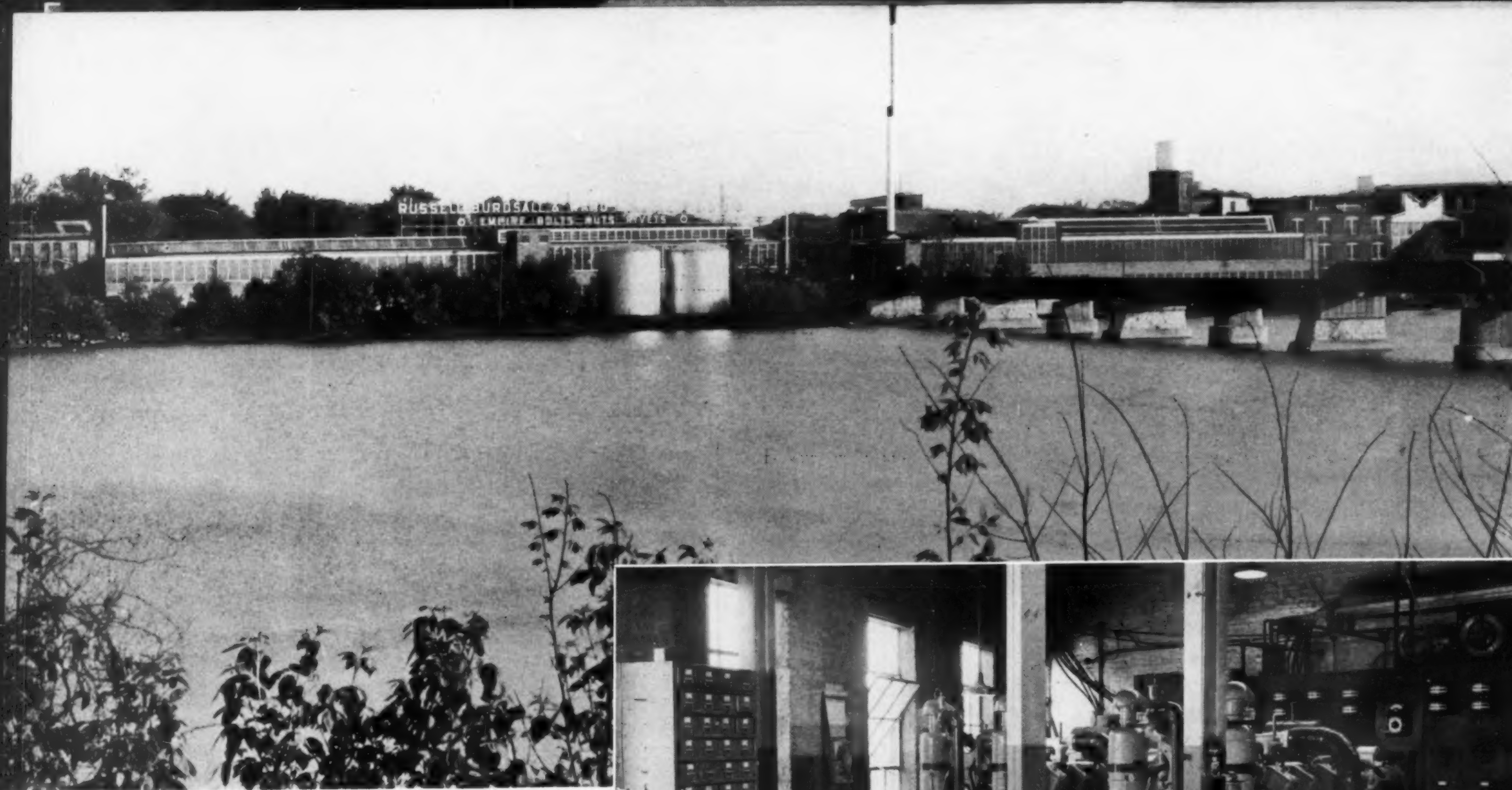
As an alternative to a joint development program of this kind, the Army Air Corps should establish a Diesel aircraft engine division of its own.[1] The Air Corps certainly cannot afford to wait and see how the Bureau of Aeronautics' Diesel projects turn out if it wants to attain parity with the German Air Force. For a number of years the Bureau of Aeronautics has concentrated exclusively on air-cooled engines while the Army Air Corps requires liquid-cooled engines for its high-performance warplanes. Much valuable time could be saved if the Air Corps undertook a comprehensive Diesel aircraft engine development and production program of its own for the benefit of our National Defense.

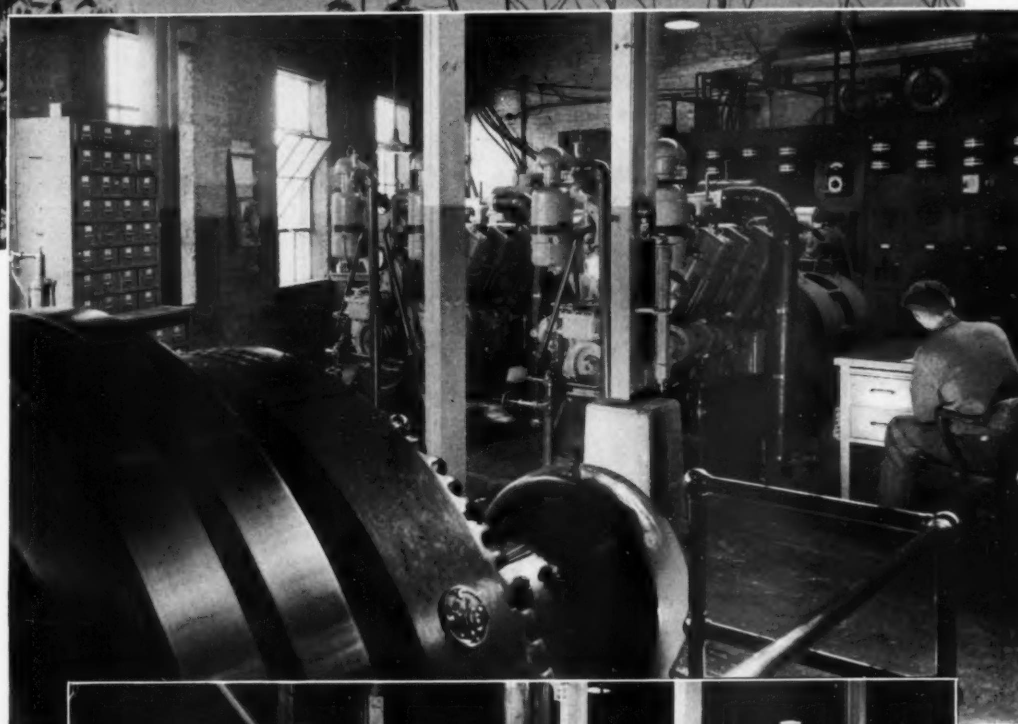
[1] *A Bill to establish in the War Department a Diesel Engine Aircraft Division was introduced by Senator Morris Sheppard, Chairman of the Senate Military Affairs Committee, at a hearing held before the Committee on June 20, 1940.*

Demonstration of some of the Junkers Ju 86-K Diesel-engined bombers of the German Air Force. Germany has built thousands of Diesels and has installed them in these ominous looking warplanes.

One of the Diesel-engined Dornier Do 18 twin-engined flying boats used by the German Air Force for patrol work over the North Sea during the early part of the European war.







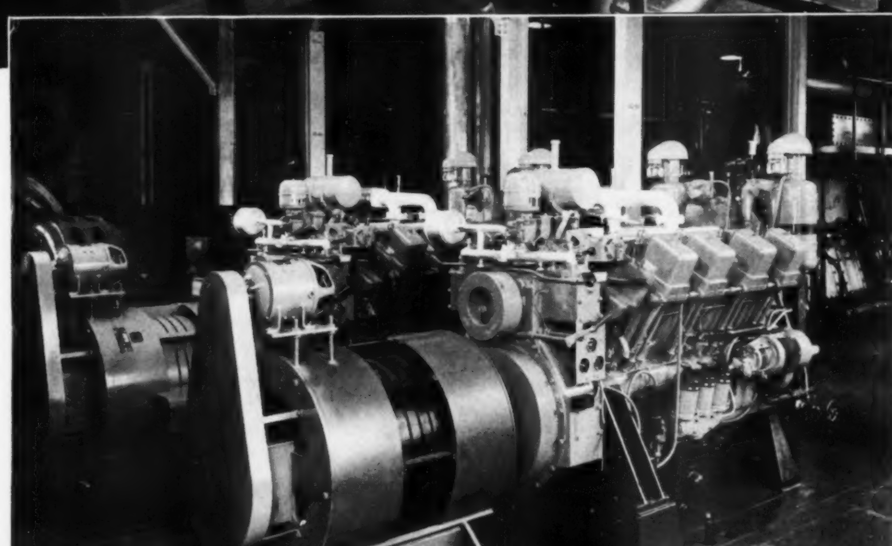
NUTS AND BOLTS WITH DIESELS

THERE is an unusually interesting Diesel Engine installation at the Russell, Burdsall & Ward Bolt & Nut Co., in Rock Falls, Illinois. This big factory—which manufactures Empire bolts, nuts and rivets—has a 750 kw. McIntosh & Seymour, and a 275 kw. McIntosh & Seymour powered generator set. Up to this time they have been using public utility for standby and week-end power; but on June 1st, they threw the switch and cut out all purchased electricity from the plant.

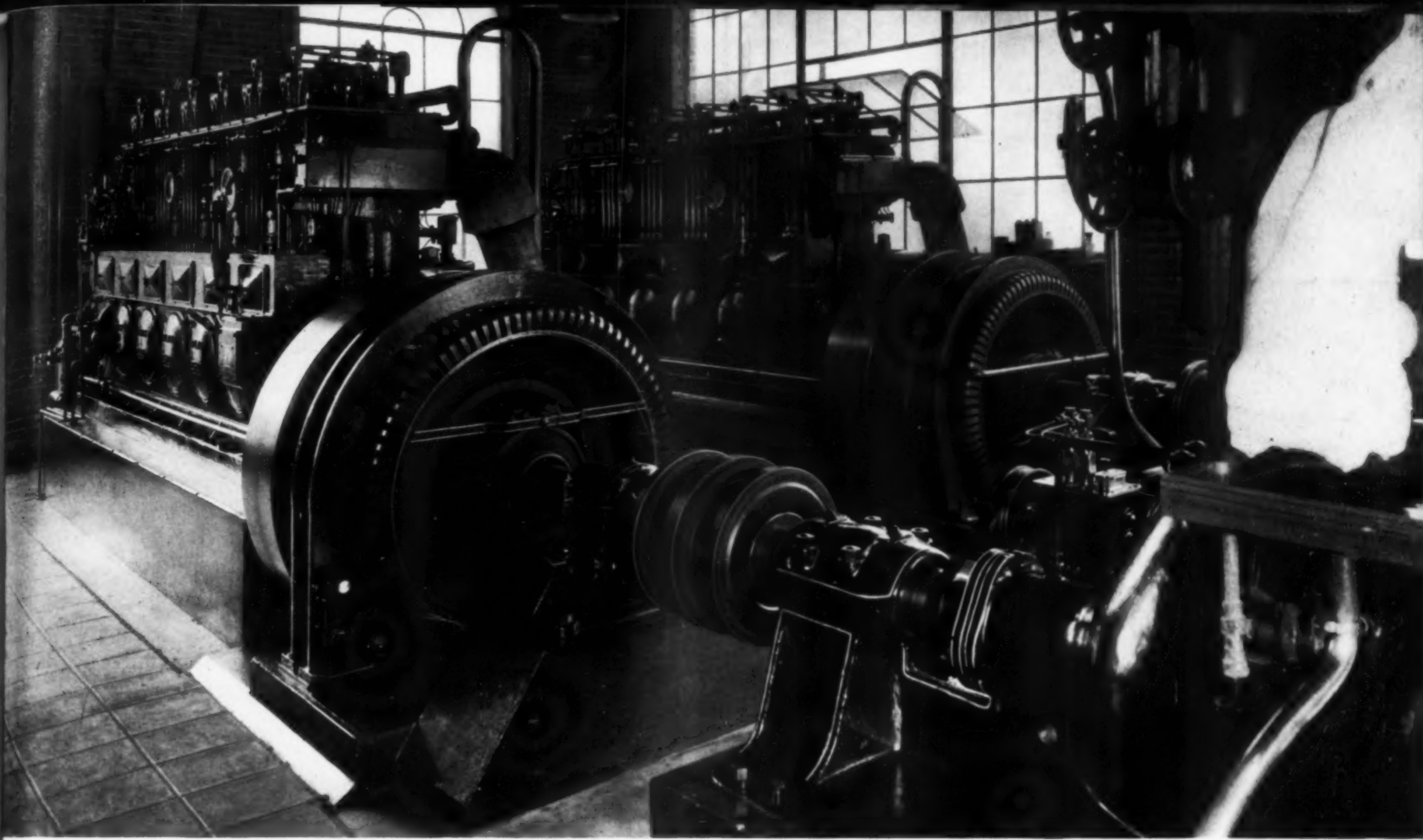
At that time they started two Caterpillar Diesel D17000 Engines, each coupled to a 100 kw. Electric Machinery Co. generator. The four engines now make an unusually flexible power set-up.

For loads under 225 kw., the D17000s are put to work. The smaller McIntosh & Seymour, plus one or two D17000s handles the load on up from that point, until it is necessary to throw in the 750 kw. of the larger unit. To that total can be added the D17000s, one by one; the 275 kw. McIntosh & Seymour; or all three, as the need arises.

Over week-ends, the two D17000 engines carry the load. The company is well pleased with its power set-up.



Top: The Rock Falls, Ill., plant of the Russell, Burdsall & Ward Bolt & Nut Co. Center: The two Caterpillar Diesel electric auxiliary generating units. Bottom: Another view of the auxiliary units with one of the McIntosh & Seymour main Diesels in the background.



W. B. Chaffee Artificial Ice Plant located at East Providence, Rhode Island, where two 180 hp. Atlas Imperial Diesel engines have supplied all power requirements since 1934.

DIESEL ICE PLANT DATA

By WILL H. FULLERTON

THE cost of manufacturing artificial ice with power from Diesel engines has been discussed many times with claims and counterclaims both for and against this type of plant. Because of the ever-increasing interest in Diesel engines for ice making, it is the purpose of this article to describe a typical Diesel-powered plant of average size that has been in operation sufficiently long to provide representative operating figures on fuel and lubricating oil costs, maintenance, and repairs and ice production records from which actual expenses can be determined.

The W. B. Chaffee Artificial Ice Plant of East Providence, Rhode Island, has been selected since it most nearly fulfills the above requisites. This plant has a rated capacity of approximately 80 tons per day with refrigerated storage facilities for 1500 tons. It has been operating on Diesel-generated power since 1934, and accurate figures are available on power costs, as well as ice production. It should be stated at this point, however, that no attempt will be made to draw comparisons with purchased power charges, since both electric rates and fuel oil prices vary in different sections of the country. Hence, it will be necessary for each reader to estimate comparative costs on the basis of fuel consumed and tons of ice manufactured according to prevailing rates in his own locality.

The Chaffee plant consists of two 10″x10″ York ammonia compressors rated at 40 tons each for ice making, or 65 tons each for refrigeration, and directly connected through flexible couplings to two 6 cylinder Atlas Imperial Diesel engines that develop 180 hp. each at 300 rpm. Between each engine and compressor is mounted an AC generator of 50 and 75 kw. capacity, respectively. These provide electric current for lighting and motor-driven equipment. In addition, there is a 6″ x 6″ motor-driven compressor for precooling well water from approximately 50 degrees to 36 degrees F. before it is admitted to the freezing cans and a similar 4″ x 4″ motor-driven compressor that maintains a temperature of 28 degrees F. in the large storage room. The day storage room is maintained at 22 degrees F. by refrigeration from the two main compressors. Motor-driven pumps supply all water required from two wells on the property, one 425 feet and the other 600 feet deep. The usual hoists, circulating water pumps, air compressors, and other auxiliary equipment common to a plan of this type are all powered by the Diesel-driven generators. The accompanying illustrations together with the preceding information will provide the

A corner of the 1,500 ton storage room showing the automatic stacker. Note the unusually clear ice produced by this plant.

necessary mental picture of the plant required for a complete understanding of operating costs and production figures to be given.

The two Atlas Diesels were installed and placed in active service in June of 1934 and produced 10,801 tons of ice during the balance of that year. The first full year of operation, 1935, showed the following results: Ice manufactured totalled 16,708 tons with No. 1 engine operating 4,780 hours and No. 2 engine operating 3,956 hours. Fuel consumption for both was 73,505 gallons at 4½ cents per gallon, and 330 gallons of lubricating oil was used at a cost of 52 cents per gallon. The total cost of fuel and lube oil was, therefore, $3,479.32 to produce 16,708 tons of ice, which amounts to only 21.8 cents per ton. Needless to say, this represented a substantial saving over previously purchased electric power.

At the beginning of 1937, Mr. Chaffee decided to expand his business to include fuel oil as well as artificial ice so that fuel consumption figures for following years must be considered on that basis, since additional power from the engines was required for oil pumping. Such a combination, however, is not uncommon in this type of business and the figures should prove interesting even though it is not possible to stipulate exactly what amount of fuel was used for ice manufacture and what amount for oil pumping, except by pro-rating on the basis of 1935 when no oil was handled. The following table speaks for itself:

Year	Fuel (gal.)	Tons of Ice	Oil Pumped (gal.)
1935	73,505	16,708	
1936	79,820	16,320	744,958
1937	82,124	19,230	905,157
1938	85,762	17,280	1,112,680
1939	87,540	17,680	1,755,134

Lubricating oil consumption remained approximately in proportion to that of 1935 except for one year when piston rings other than those recommended by the manufacturer were installed. The immediate increase in lube oil required was so great that the owner returned to the standard type at the next overhaul period, at which time it returned to normal.

When the Diesels were first placed in active service an arbitrary reserve for maintenance and repair was set up on the basis of three cents per ton of ice produced or approximately $1.30 per horsepower per year. At the end of 1939, or after five and one-half years of constant operation, the actual cost of replacements, as taken from invoices, amounted to $925.88, or only $0.47½ per hp. per year, which is approximately one third of the established reserve not counting labor or regularly employed personnel. Chief Engineer, Clarence Frey, is particularly pleased with the condition of both Atlas Diesels after five and one-half years of constant duty, and reports remarkably slight cylinder wear. During this time, the main bearings have not been touched and all that has been necessary on the connecting rod bearings has been to remove a shim or two. Each engine is shut down for complete overhaul once a year during the slack season because there is no time for anything but routine adjustment at other times when both engines are running constantly and both are in operation the greater part of each day. Such a record is typical of heavy-duty Diesel performance and affords ample proof of Diesel dependability for continuous service. On

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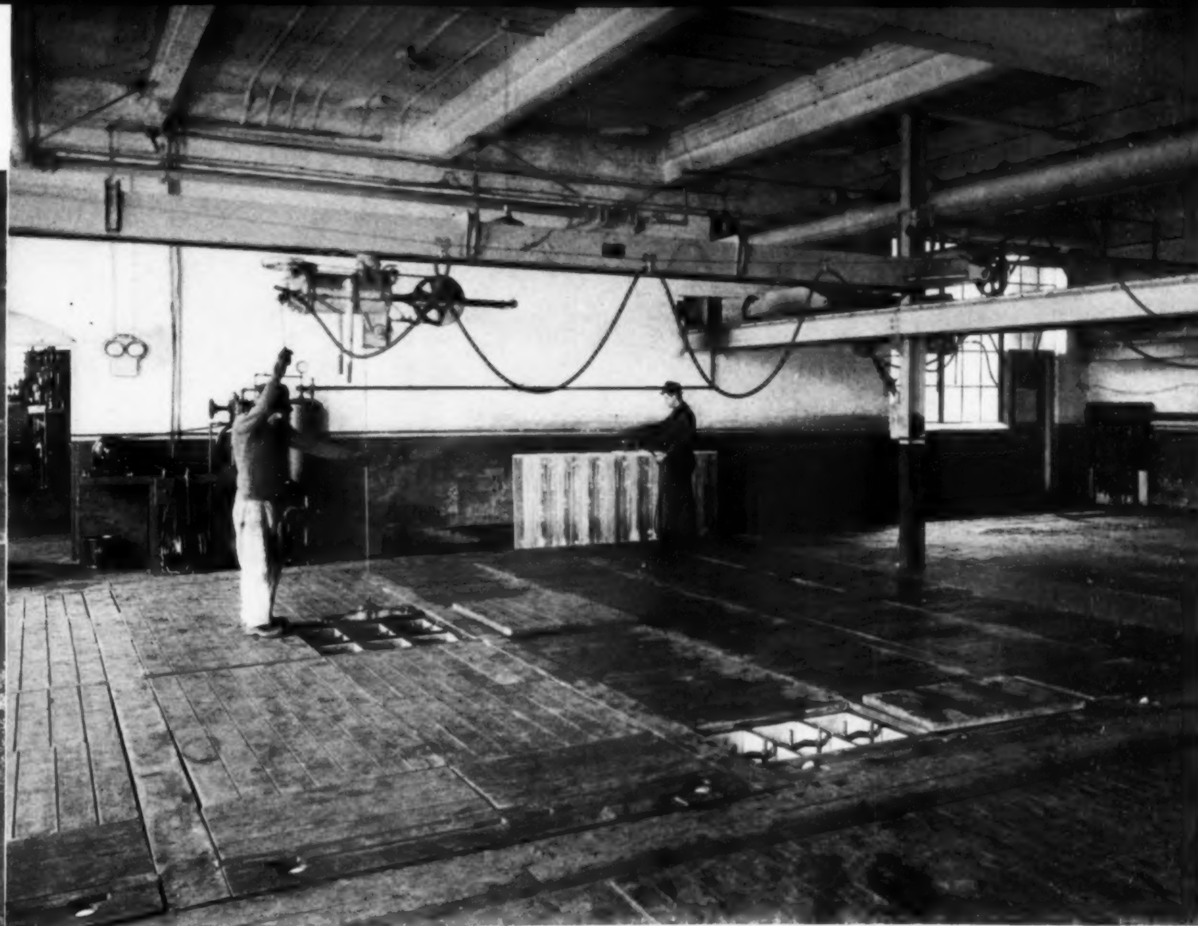
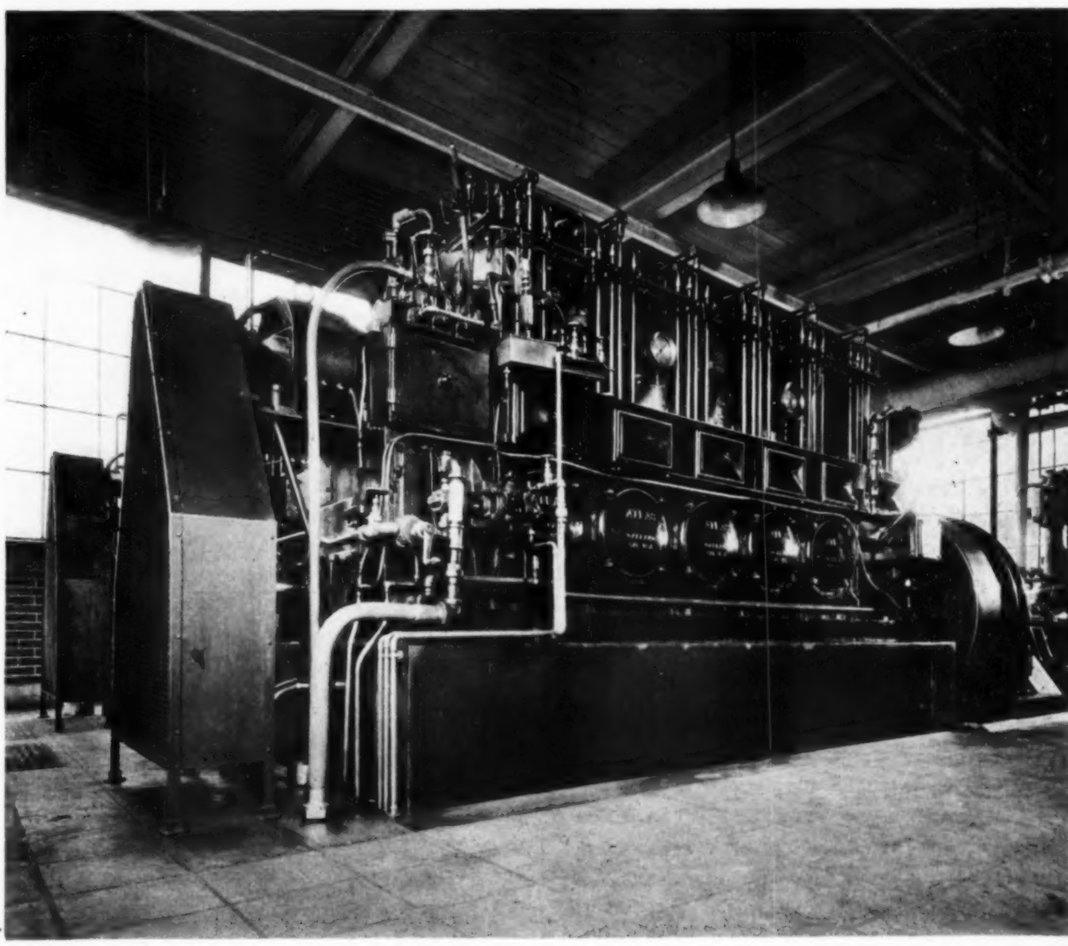
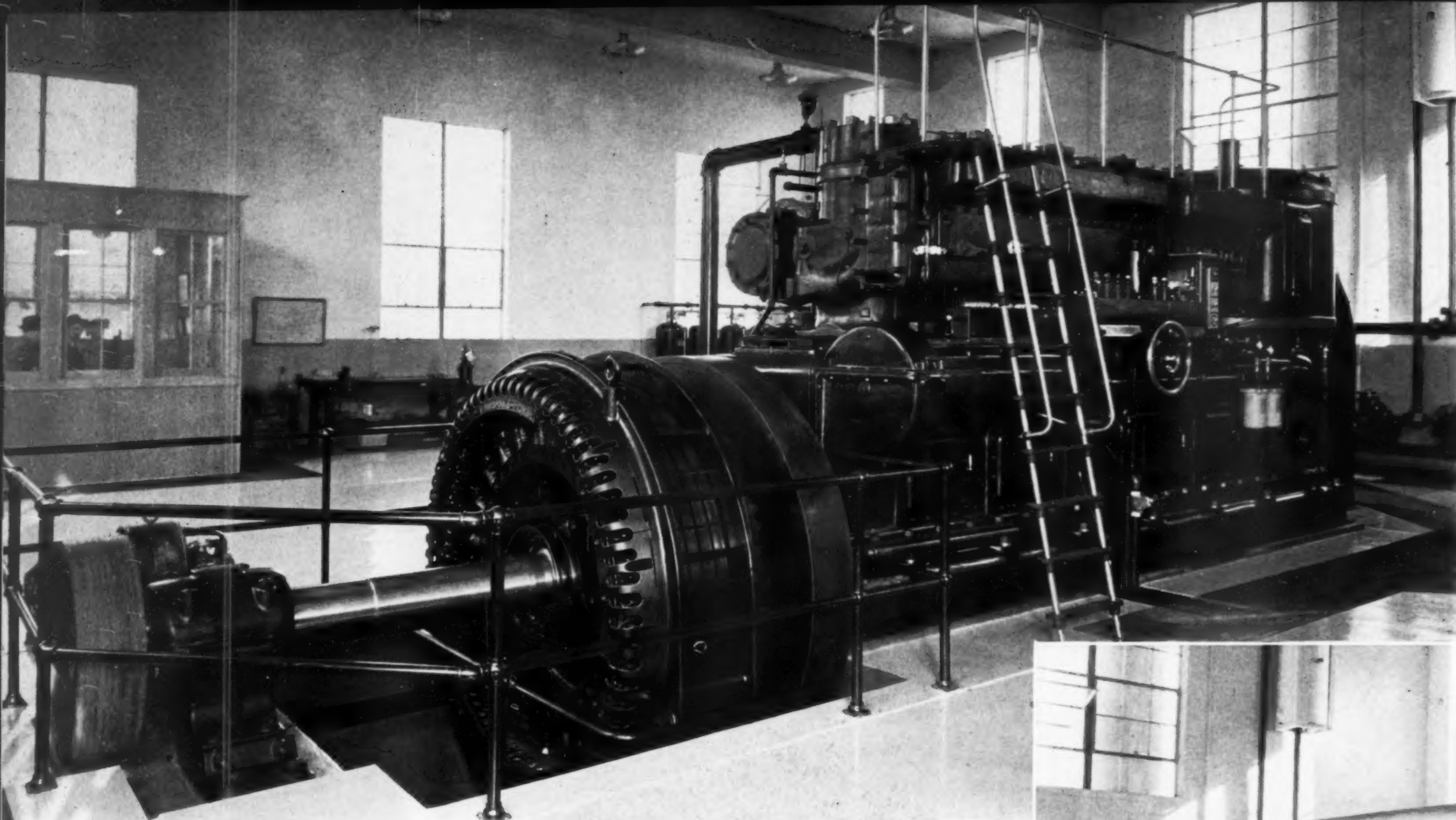


One end of the tank room showing ice being drawn and placed on the conveyor which connects to the storage room at the extreme right. The Atlas Diesels can be seen in the engine room beyond at the left.

the basis of such economical and dependable power production it is obvious why the popularity of heavy-duty Diesel engines for artificial ice manufacture is increasing by leaps and bounds. One sure way to lick competition is to cut operating costs and Diesels will do just that with no sacrifice in personnel charges or availability when power is required.



One of these two 180 hp. Atlas Imperial Diesels is always in operation throughout the year and both are running continuously during summer months.



The new Fairbanks-Morse, 5-cylinder, 875 hp. Diesel generating unit at Seaford, Delaware. Note Nugent twin fuel oil filter and Manzel mechanical lubricator.

SEAFORD, DELAWARE

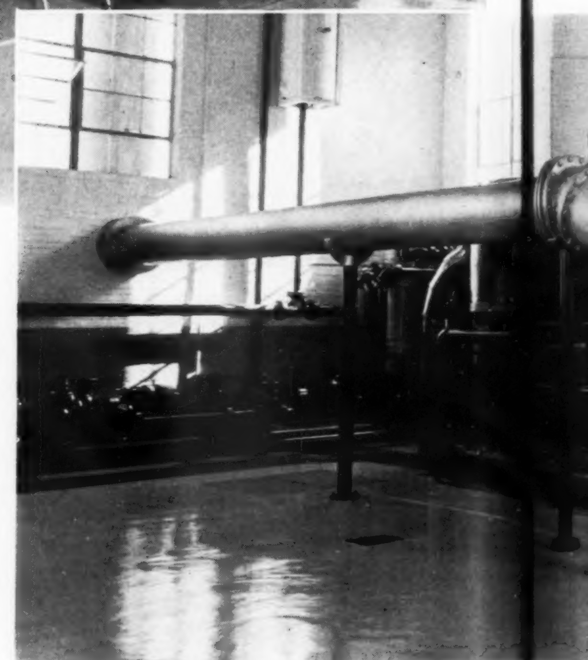
By W. H. GOTTLIEB

THE power plant at Seaford, Delaware, is municipally-owned and operated today, but the city did not acquire the system until literally the plant had sold itself. It is common practice for municipalities, intent upon enjoying the economies of home-owned Diesels, to vote a bond issue and purchase the generating equipment. They have the assurance of reputable engine manufacturers and the example of other successful projects to guide them. But in Seaford, the utility company was firmly entrenched and was determined to block public acquisition of a power system. The battle was carried all the way to the United States Supreme Court.

In an effort to give the city the Diesel plant it desired, Fairbanks, Morse & Co. assisted in formation of the Seaford Light & Power Co. This privately-owned company received a franchise for a light plant and distribution lines, with the understanding that the city could purchase the system at any time within five years. It was agreed further that any profits accruing to the system before the option was exercised would be subtracted from the purchase price.

Thus, the Diesel plant had to prove its worth before purchase would be consummated. It took just eleven months to convince Seaford that the plant should be bought without delay. Earning prospects were so good that Fairbanks-Morse was willing to accept certificates payable only from plant revenues. The company's confidence was justified, for in the first twelve months of municipal operation, the plant earned a profit of $43,680, nearly double the amount required for interest and retirement of certificates.

The original plant, put into operation on November 1, 1937, contained three 300 hp. Fairbanks-Morse Diesels, each of four cylinders, 14 x 17 in., operating at 300 rpm. and using mechanical injection, crankcase scavenging, and the two-stroke cycle principle. Each engine was direct-connected to a 200 kw. AC generator and 7½ kw. exciters, all the product of Fairbanks-Morse.



General engine room view showing the three original F-M, 300 hp. Diesel generating units in the background.

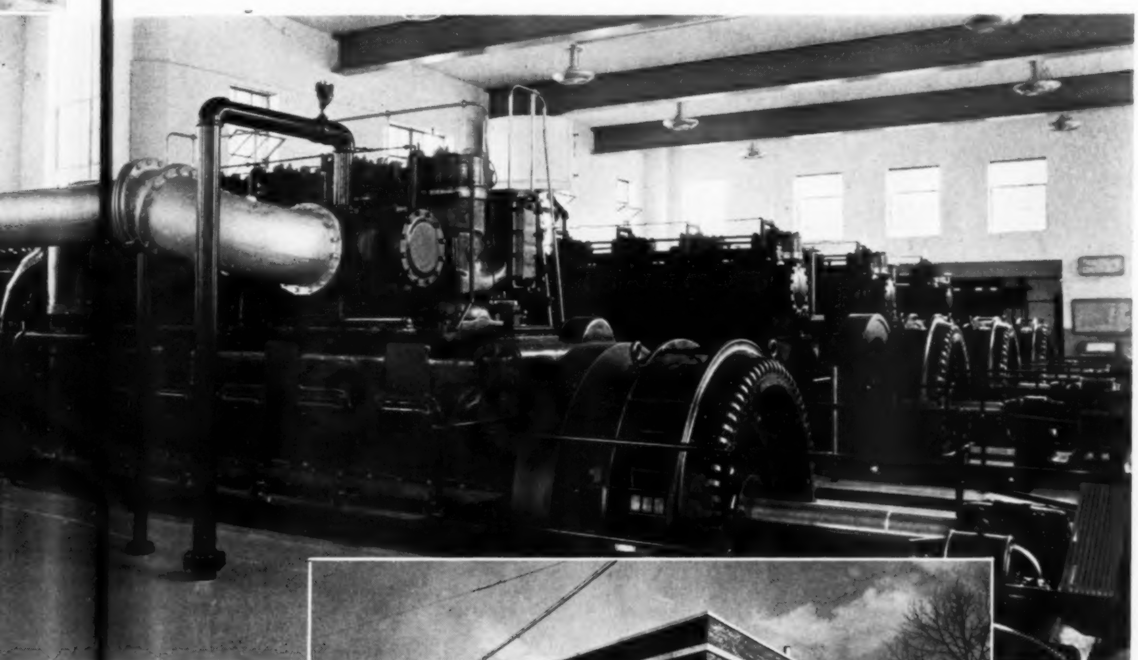
At the outset, the plant served about 500 customers and the engine capacity was more than ample, but Seaford was destined to grow. The du Pont company chose the town as the site for a large Nylon factory to employ more than 1,500 persons. The factory has its own power plant, but the fact that Seaford could give assurance of adequate cheap home electric service to the army of du Pont employees influenced that company in selecting this particular location.

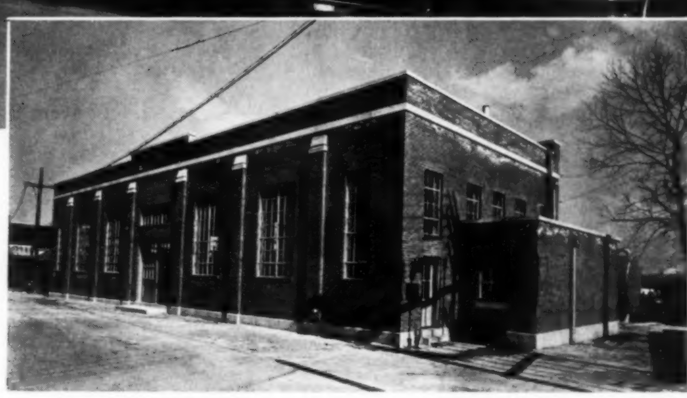
With the community nearly doubled in size, demands on the power plant came perilously near to capacity. Customers numbered nearly 1,000 and Seaford hastened to install a new Fairbanks-Morse engine. This 875 hp. unit has five cylinders, 16 in. bore and 20 in. stroke, and runs at 300 rpm. It is a two-cycle engine with pump scavenging and has solid injection of fuel. The engine is connected to a 606 kw. generator; the exciter is driven by a V-belt.

To accommodate the new power unit, a 50 x 50 foot extension was added to the original building. The ground is comparatively soft and all four engines' bases are supported by piles. The well-lighted, well-built brick structure is located on the banks of the Nanticoke River.

Engine auxiliaries are placed along the river side of the plant and face the control end of the engines. Transformers and switches are housed in an annex and arranged so that the Marquette Electric switchboard is flush with the side wall of the plant. The board is equipped with Roller-Smith instruments. On one panel is mounted an Allis-Chalmers Type "A" rocking contact voltage regulator with built-in resistors, change-over switch and voltage-adjusting rheostat.

Both the large Model 33-D engine and the three smaller Model 32-E units utilize the fuel system perfected by Fairbanks-Morse. Injection pumps, one for each cylinder, are located in a built-in auxiliary fuel reservoir kept primed automatically by a single special built-in supply pump. Since the injection pumps are submerged in fuel, there is no need for separate piping to each pump. Excess fuel delivered to built-in fuel reservoir is returned through overflow by gravity to day tank located below floor level. The pumps are operated by cams and force the oil through differential spray valves directly into the cylinder combustion space. Isochronous governors regulate the amount of fuel passing through the pump suction valves. All the engines are equipped with motor-driven synchronizers operated from the switchboard.





Seaford Light and Power Company's modern plant.

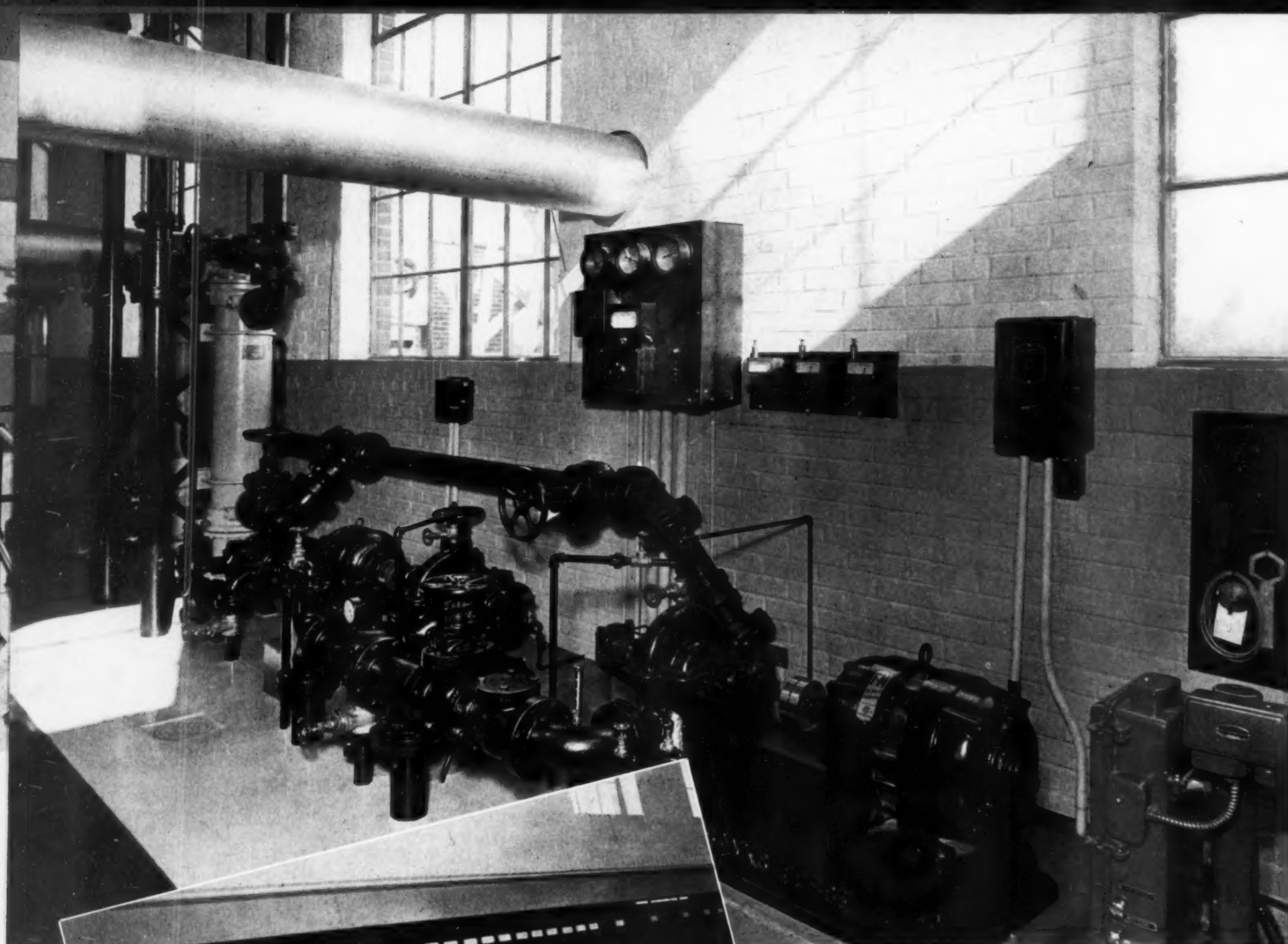
Seaford stores fuel in a 15,000 gallon tank and a new 25,000 gallon tank. An F-M transfer pump permits unloading oil from river barges. From storage, the oil flows to the three 300 gallon day tanks for the smaller engines and to the 600 gallon tank for the large engine and is then drawn through screens to the engine reservoirs by built-in supply pumps. All tanks are equipped with Liquidometer tank level gauges. A Nugent filter is employed on the large engine. Cities Service fuel is used for all engines.

On the three Model 32-E units, lubricating oil is pumped to a multi-point mechanical lubricator which supplies both bearings and cylinders. Main bearings are of the ring-oiling type. On the large Model 33-D engine, a built-in high-pressure pump circulates oil to a header in the lower base and then by branch lines to all main bearings. Cylinder lubricant is distributed by a mechanical lubricator. Standard Oil Co. lubricating oils are used, Diol 55 in the three 300 hp. and Tres in the 875 hp. Purolator filters are installed on the 300 hp. engines. All lubricating oil is centrifuged periodically with a Goulds Hydroil.

All four engines have enclosed cooling systems. Three F-M pumps bring raw water from the river, three more circulate the jacket water and a seventh serves as an auxiliary which can be switched to either use. A Permutit softener prepares water which is circulated through the engine jackets from 500 gallon and 200 gallon soft water tanks. Jacket water is cooled in Schutte-Koerting shell and tube heat exchangers.

The Model 33-D engine has an oil-cooling system for its pistons. The same pump that supplies raw water to the jacket water heat exchangers sends river water through a Schutte-Koerting oil cooler. Each engine is provided with a water-cooled exhaust manifold from which an overhead exhaust line, painted aluminum, runs out to individual vertical Maxim silencers. Exhaust pyrometers are Alnor. Engines are equipped for air starting. Three new air starting tanks have been added to the first three, but the original Fairbanks-Morse compressor remains adequate to all needs. The original plant contained a Diesel Plant Specialties Co. alarm system. A new Roller-Smith alarm panel was added with the 875 hp. engine.

In two and a half years of operation, the total engine repair bills were but $200. There has never been a breakdown. Thus, repair costs average only $80 a year.



Above: Battery of F-M motor-driven cooling water pumps. The Schutte-Koerting heat exchanger, and Alnor pyrometer show in this view. The valves are Crane. Left: The flush type switchboard with Roller-Smith instruments and Allis-Chalmers voltage regulator. Below: Exterior view showing the four Maxim exhaust silencers.

Seaford's well-equipped plant is returning excellent operating results. J. F. Deakyne, plant superintendent, reports generation of 12 kwh. per gallon of fuel. The cost per kwh. is reported at 4 mills at the switchboard and less than 7½ mills delivered to the customer.

This operating record means money in the bank for Seaford. At the end of the first full year of municipal operation, Jan. 31, 1940, balance and receipts totaled $71,651.35. Operating expenses of the plant and line department amounted to only $16,896.75. Total disbursements, aside from interest and debt retirement, were $27,970.93, leaving an operating profit of $43,680.42. With $10,332.70 paid out in interest charges and $13,000 for debt retirement, there was still a net profit of $20,347.72.

These savings are being passed on to the consumer. Only recently, rates for domestic consumption were substantially reduced.

The spectacular launching of the new Diesel River Towboat WILLIAM PENN.

WM. PENN

By DOUGLAS SHEARING

THE "Wm. Penn", one of the largest Diesel ships ever built for river service, was launched on June 19 from the Neville Island Marine Ways of Dravo Corporation. Representatives of government and industry from the Ohio Valley were among the 1,000 guests who watched the all-welded twin-screw Diesel towboat slip sideways into the Ohio River after it had been christened by Mrs. Thomas M. Woodward, wife of the Vice-Chairman of the U. S. Maritime Commission.

Mr. and Mrs. Woodward were guests of honor at a luncheon meeting held to celebrate the occasion. Commissioner Woodward addressed the assembly on "The Significance of River Transportation in National Defense".

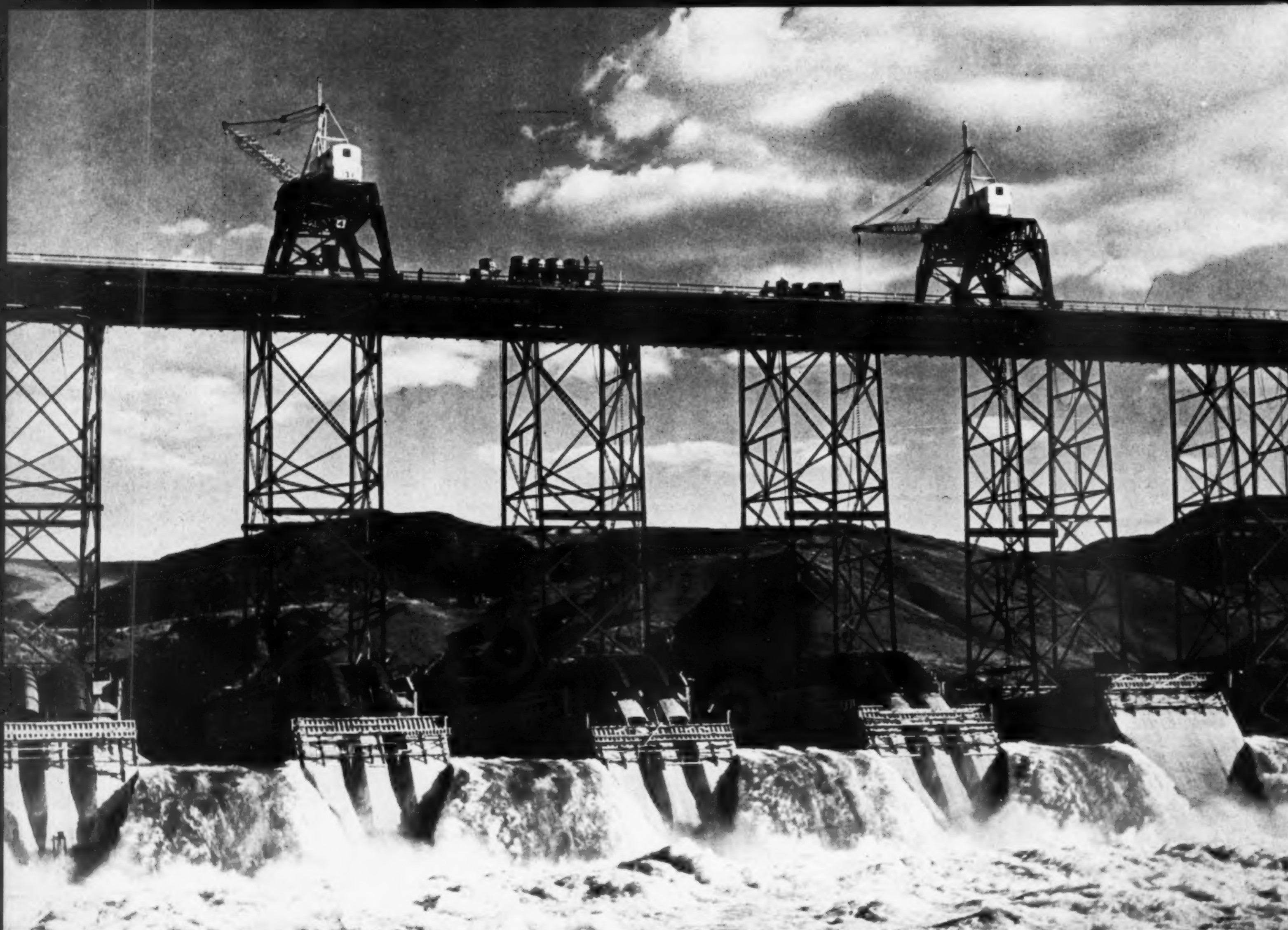
When completed, the "Wm. Penn" will enter the service of the Union Barge Line Corporation as the most powerful boat in that company's "Great White Fleet", and will play a prominent part in the two-directional movement of traffic on the Ohio and Mississippi rivers. Designed to push, stop, steer and flank large flotillas of barges fastened to her prow, the motorship will stem the rivers, under average conditions, with not less than 10,000 tons of freight.

The vessel has a hull 176 feet long, 36 feet wide and 10 feet deep when fully equipped and carrying her 21 day supply of fuel, she will have a draft of 6 feet, 9 inches. Her two engines are eight-cylinder direct reversible Superior Diesels rated at 650 hp each. Each engine drives an 84 inch, four blade propeller.

The propulsion of the craft is unique in that the propellers are partially enclosed by a special tunnel design and fully encircled by modified Kort Nozzles. These features increase the propulsive thrust of the vessel and make it possible to combine maximum pushing power with exceptional maneuverability. As a result of the Kort Nozzle installations, it is estimated that the effective push developed by the boat will be increased approximately 30 per cent above that which would otherwise be developed from the rated capacity of the engines.

To enable the "Wm. Penn" to steer equally well either backward or forward, two sets of rudders are used, one ahead and one aft of the wheel. This combination insures successful flanking on those occasions when flanking is required, although screw-propelled boats render flanking necessary only at infrequent intervals.

The Great White Fleet will now have four Diesel towboats, these being the "Neville", "Peace", "Dravo 42", and the "Wm. Penn".



View showing five of the fifteen waterfalls in the Grand Coulee Dam during the 1939 flood season. Note concrete trains atop the bridge.

DIESELS HAUL 30,000,000 TONS

By CHAS. F. A. MANN

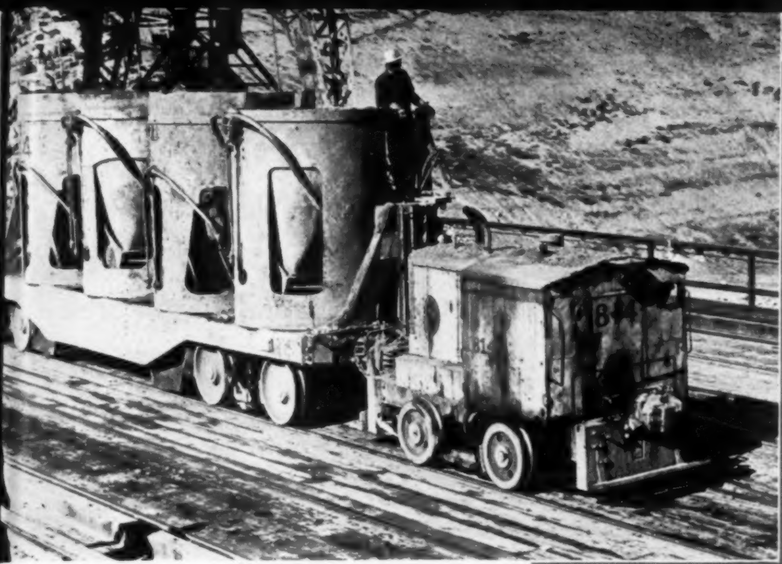
BY THE middle of 1941, the most stupendous construction job ever undertaken will reach the primary completion stage. At that time, the great Grand Coulee Dam and irrigation pumping plant will be well along toward completion and the Dam itself, together with a portion of the huge power plant, will be finished.

The most concentrated railroad freight movement in construction history will become a record to shoot at for many years to come. And the twenty husky little standard-gauge Diesel locomotives will have more than earned the pleasant retirement in a friendly, peaceful junk-heap (unless they are assigned to service on the Shasta Dam concrete pouring job—which is not likely).

Because of the great size of Grand Coulee Dam, with its base more than 500 feet wide—two or three city blocks—and its length nearly three quarters of a mile, two huge trestles were built by the MWAK Company for the construction of the original Foundation Dam. The first trestle was built with its center-line 93 feet from the upstream face and a second with its centerline 312 feet from the upstream face.

Across these huge steel structures, containing about 16,000 tons of structural steel, most of which lies buried in the deepest part of the dam itself, came the concrete and steel trains in an endless stream that never stopped for nearly three years. In this original job under the Mason-Walsh-Atkinson-Kier contract for the Foundation Dam, there were fourteen Davenport DE-10 Diesel Electric ten-ton locomotives. These hauled four concrete cars or buckets, mounted on a single four-wheel steel flatcar. Each of the four buckets handles four cubic yards of concrete, each yard of which weighs approximately two tons, or a total of 32 tons of concrete per trip. An extra space for one bucket on the car permits a crane to deliver an empty and remove a loaded bucket each round trip toward the area of pour.

After pouring some 10,000,000 tons of concrete and carrying half as much tonnage of structural steel, valves, forms and piping, these two giant trestles were dismantled during the summer of 1938 and construction of a single high-level trestle was finished by September, 1938. The trestle is 3,600 feet long and its towers vary



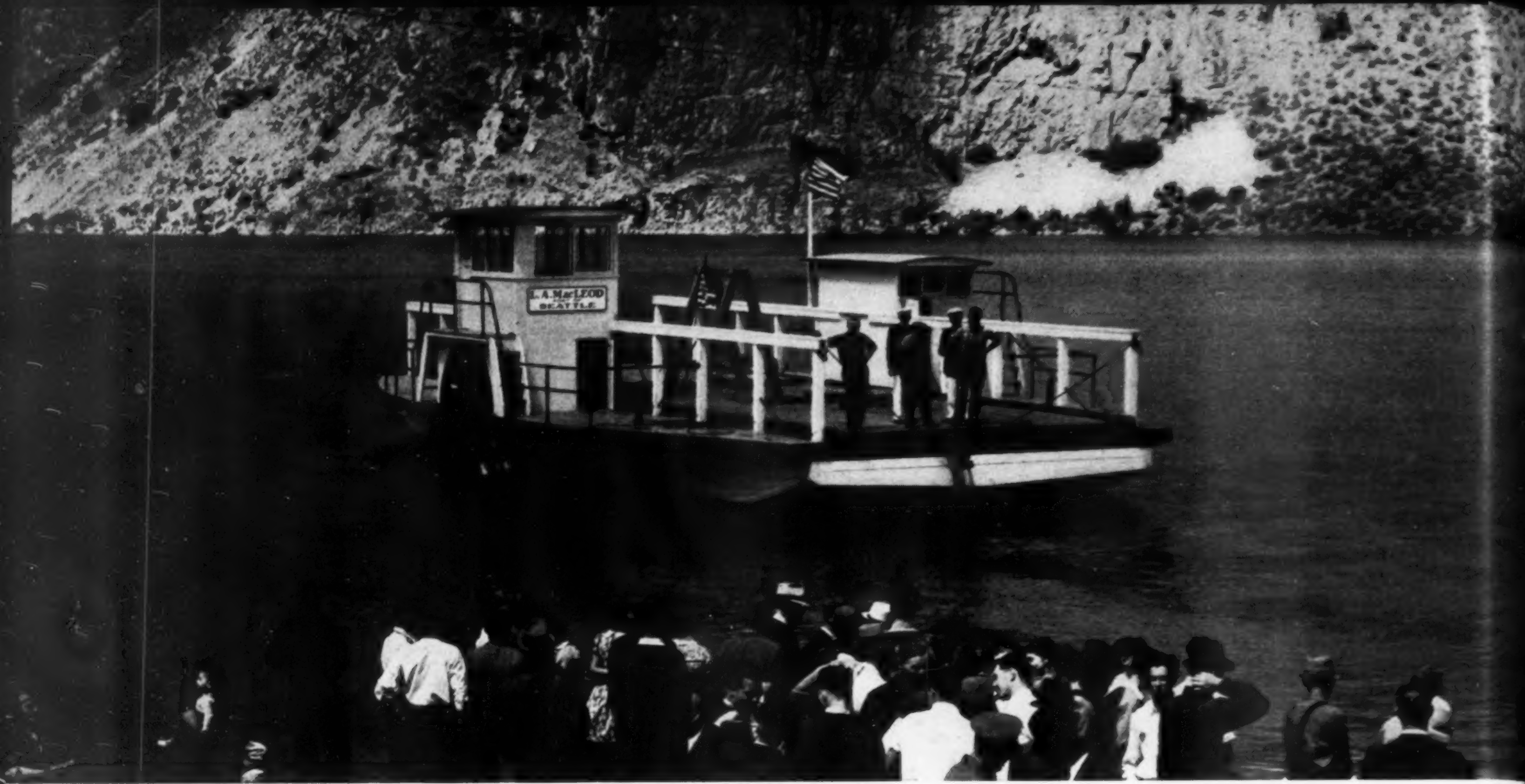
Remote-controlled Davenport Diesel-Electric locomotive with concrete train.

from 185 to 205 feet above the line of the Foundation Dam. Concrete flowed in an endless stream for the greatest single concrete or masonry project in the history of the world, into the waiting groups of four 4-yard concrete buckets, to be hauled out on the bridge railway and dumped into the forms. Nearly 600,000 yards of concrete have been poured at Grand Coulee in a single month. Over 20,000 tons were poured in a single twenty-four hour period.

To the original fourteen Diesel-electric locomotives, six more have been added to the fleet. During the greatest period of concrete pouring, a 32 ton cement train left the giant mixer every 90 seconds. Out on the structure full—back empty—and at a faster clip. The Davenport Diesels are equipped for remote control from six positions on the cement car, so the operator is also the hook tender and can safely operate the cement trains from most any point on his load.

For about 4,500,000 cubic yards of concrete the average haulage was 1,000 feet and for the remaining 6,500,000 yards it was 1,600 feet, which gives a ton-mileage of astronomical proportions. Across this four track railway will be hauled some 13,000,000 tons of concrete and 7,000,000 tons of steel, conduit, valves and piping. About 30,000,000 tons of material will be piled up on the haulage record sheet of the three trestles, all of which has been handled by these tiny, standard-gauge Diesel locomotives. They have a 4 cylinder, 88 hp. Caterpillar Diesel, with an 80 hp. Westinghouse D.C. generator and two 43 hp. Westinghouse motors geared to the axles. Each Diesel locomotive has a drawbar pull of about 6,500 pounds, which was increased by about one ton of ballast to prevent wheel slippage, on six of the locomotives. So, across the top of the World's biggest dam, in the hot dry desert summer winds and in the cold snowy winter storms, this fleet of twenty locomotives has piled up some of the most startling records ever made by Diesel engines. Here, instead of fuel consumption, dependability and flexibility was the cost-determining factor. One failure in the schedule of one cement train means that 25% of the Coulee concrete pouring capacity is tied up. And when you're pouring nearly 1,000 tons of wet concrete so stiff it will hardly flow, each hour of each of the thirty days in each month for over two years, Diesel dependability takes on a meaning unlike any other meaning in the catalogue.

Lowering 8 tons of concrete off a cement train at Grand Coulee Dam.



This novel geared side-wheel Diesel-driven ferry must be almost amphibian to negotiate the rapidly changing channels and beach landings of Coulee Lake as it fills behind Grand Coulee Dam.

GEARED SIDE-WHEEL FERRY

By CHAS. F. A. MANN

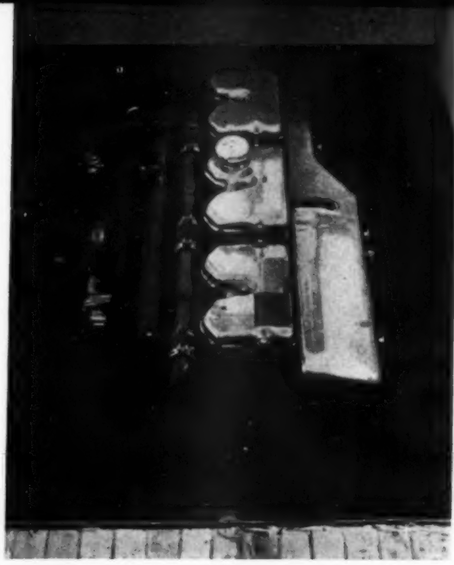
THE vast lake behind Grand Coulee Dam is rising fast. By the Fall of 1940, practically every highway crossing of the Columbia River between the Great dam and the Canadian boundary, a distance of about 150 miles, will have to be revamped. Bridges are being drowned out. Old ferry routes are being widened and their approaches flooded by the rising waters of Coulee Dam. The immediate problem on the major routes is to provide an extremely flexible, low-cost ferry service that can negotiate the rising flood, navigate new currents in strange channels with speed and safety, and literally "find a place to light" right on the beach!

At Keller, Washington, where State Highway No. 4 crosses the Columbia, the Coulee Lake will be wide and follow a swiftly changing shoreline. This is caused by the fact that the lake will be deepest and widest here as it is very close to the upstream face of Coulee Dam. The highway leads north to the rich mining and forest country in Okanogan County, the wildest, most rugged, and largest county in the state, with the town of Republic at its northern end.

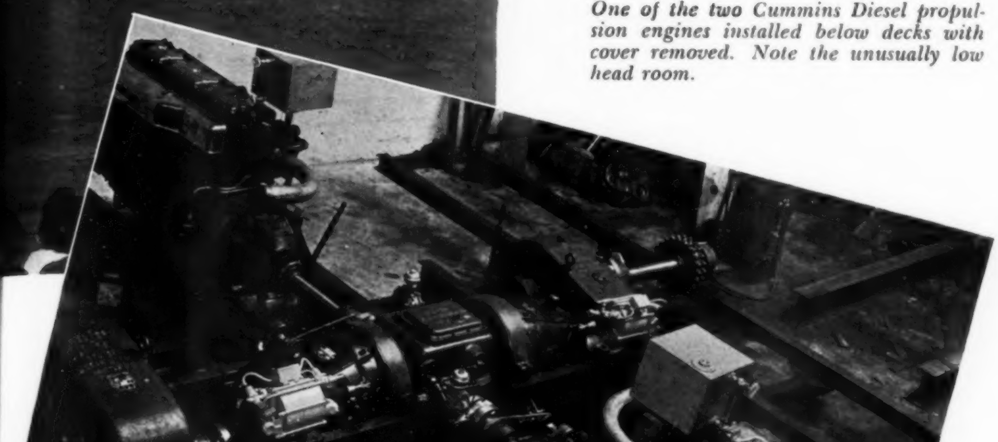
The State Highway Department early this year decided to replace its antique cable-drawn ferry with a modern, flexible little ship that could shuttle across the river quickly and provide frequent service in rush hours. With the landing slips being constantly changed—hauled up the sides of the rising shoreline by tractor, nothing but a flat-bottomed side wheeler would work. Propellers wouldn't last a week. The vessel must be of shallow draft, easy to repair and of cheap wooden construction. You hit a rock in the river and run the ship ashore for a little expert carpentering and back into service it goes. . . ! This is characteristic of all Columbia and Snake River vessels. Steel hulls acquire dangerous, permanent dents that cost money to repair. Gasoline and steam power were out because of expense, fire hazard, and repair facilities. Fuel is also hard to get and expensive.

The state arranged with Thomas Tuttle, of Lakeside, Washington, an old time Columbia River boat builder, to follow out his best ideas for a ferry with a capacity of eight automobiles and passengers. J. D. McVicar, of the Highway Dept. Engineering Staff represented the state in designing the craft. Plans were drawn, based on the builder's experience over many years. The result was the new ferry *L. A. MacLeod,* with the name of the home port of Seattle—150 miles away—carried on its pilot house.

The ship is of heavy wooden construction, draws 18 inches loaded, is scow-ended and flat-bottomed like a fish barge. It is 65′ x 24′ overall, and has two paddle wheels just off center, one on each side, protected by housings on top. The outstanding feature of the entire craft is its



One of the two Cummins Diesel propulsion engines installed below decks with cover removed. Note the unusually low head room.



Above center — Shop view of the Diesels and transmission hook-up. Complete maneuvering controls are carried to the pilot house. Next above — View of the power transmission equipment installed.

compact, elaborately controlled machinery. The power plant, all below deck, was worked out by A. E. (Duke) Young of the Cummins Northwest Sales Company of Seattle, and provides a hook-up of two 100 hp. Cummins Diesels, through clutches, reduction gearing, reverse gearing and a Hypoid gear, with full pilot house control, so that each paddle wheel can run forward or reverse, alone or together, with one or both Diesel engines.

The layout is set on a riveted steel frame and has extremely low headroom. The Diesels are center mounted, fore and aft, driving the Hypoid gear, built by Western Gear Works, Seattle, through Twin Disc clutches mounted on each engine. From the center-mounted Hypoid gear, shafts extend at right angles to the Diesel drive shaft, to two vacuum operated Twin Disc MG125 reverse-gear-clutch units with 1:1 ratios, thence through a 13.96 to 1 reduction gear mounted at the outer end of each shaft, on the low-speed shaft of which is a chain-sprocket to drive the paddle wheel at each side. Flexible couplings are provided at each sprocket and a separate Bendix vacuum pump, operating the two Bendix vacuum clutch controls. Harrison heat exchangers are fitted to each engine with thermostatically controlled water and lube oil temperatures. Engine speed controls, clutch-reverse gear controls and all gauges are carried up to the pilot house from the engine room.

Normally the ferry operates on one engine, but both may be used, or one held as a spare. Instant control is provided, with quick-acting electric starters. The ferry operates from 6 A.M. to 10 P.M. and make a trip across the river in ten minutes, at a speed of ten miles per hour. Her paddle wheels are of light wood construction, each 9 ft. in diameter. At engine speed of 1,500 rpm. the paddle wheels turn about 40 rpm. The chain sprocket is geared to the paddle wheel sprockets at about 2½ to 1 ratio. With one engine operating, she will use about 3 gallons of fuel per hour.

The twin Cummins engines are Model H type, 6 cylinders 4⅞" x 6", and have water-cooled Twin Disc clutches and a Hypoid gear, all cooled by Buckman pumps from cold river water. The vessel has four small hydraulic rudders, one on each side at each end, controlled by a lever in the pilot house instead of a steering wheel.

The Highway Department has indicated that it will replace other state ferries on the Columbia with similar equipment and is highly pleased with the performance of this novel ferry that can meet all problems of river navigation.

Exterior of the Kilborn-Sauer plant at Fairfield, Conn., where Diesels make hardware and automobile accessories at a reduction.

YANKEE MANUFACTURER DIESELIZES

By WILL H. FULLERTON

"WE'RE for Diesels 100%"—That is the opinion of Kilborn-Sauer Company of Fairfield, Connecticut, shrewd Yankee manufacturers with over a quarter of a century of experience.

This progressive firm, known through their industry as outstanding producers of Marine Lights, search lights, automobile accessories and hardware bearing the trade mark K-3, is managed by Mr. Howard Kilborn and the three Sauer Brothers, Fred, Peter and Henry.

Their plant in Fairfield opened some twenty-seven years ago. Unfortunately, the profits were heavily taxed by the fat power bills they paid monthly, which grew as the years went on. In the early '30s, the savings they had heard being brought about through utilizing Diesel engines naturally aroused their interest.

At first, and then it was largely a matter of experiment, they purchased a second-hand Fairbanks-Morse 120 hp., 14" x 17" "YVA" Diesel engine, which was installed in 1933. Despite the age of this engine, its fine and efficient performance so delighted Kilborn-Sauer that, when their load increased, they promptly decided to handle it through Diesels.

Their first thought was to purchase another second-hand engine, but the added economy brought about through the savings in fuel and lubrication oil, together with a smoother and more efficient performance, swung their minds to a new Fairbanks-Morse 120 hp., Model 32 Diesel engine to run with their used equipment. This decision has proved a very wise and profitable one, and has furnished even additional satisfaction and economy. The installation of this latter engine was made by the Hitchcock Gas Engine Company of Bridgeport, Connecticut, and Mr. John Brown, President of the company, has viewed with particular satisfaction the excellent performance of this equipment.

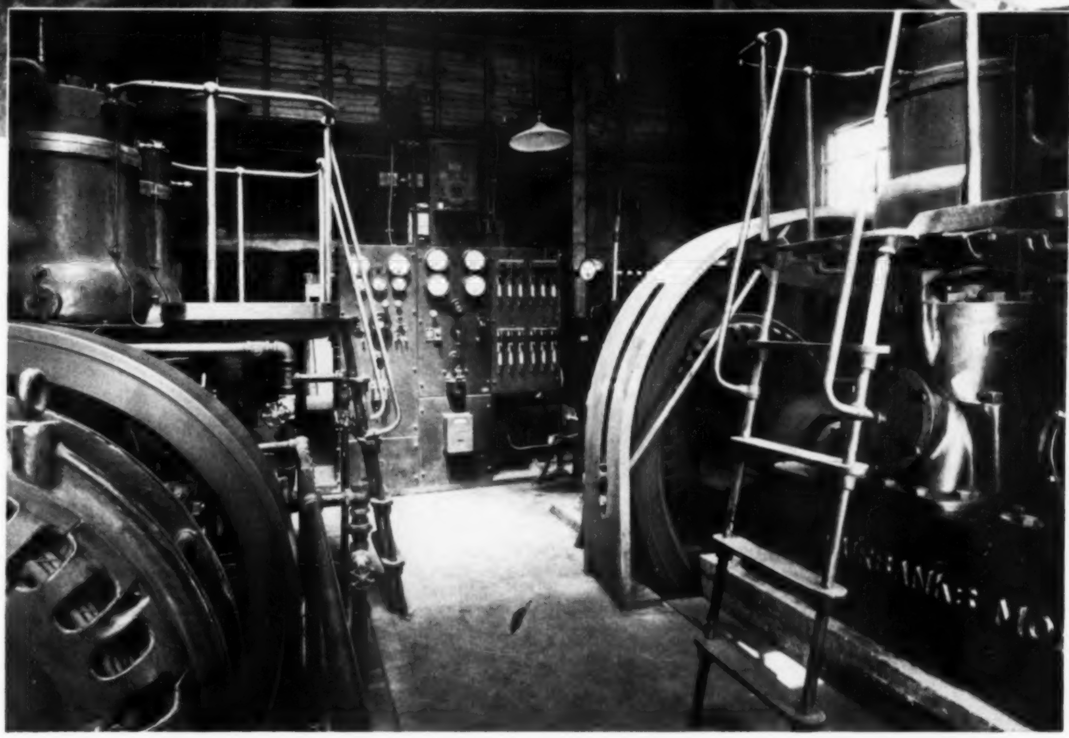
This latest F-M engine, installed in February, 1936, is of standard rotation for low mounting and with a closed cooling system. The engine room includes a double panel switchboard, with necessary instruments with switches for paralleling a 96 kva. F-M alternator and a 5 kw. exciter with a 90 kva. F-M alternator and a 7½ kw. exciter.

The new type Fairbanks-Morse 10 hp., Model 45 Diesel engine is utilized in furnishing lights for the watchman, and during the time the plant is not in actual operation.

An interesting feature is the item of heating. The cooling water is circulated through the building to assist in heating the plant. This utilizes the heat which is dissipated by the engine and is sufficient to always keep a chill from the plant.

It might be mentioned here that operation of the engine is so simple that though Mr. Fred Sauer visits the engine room periodically during the day, the time consumed only amounts to 30 minutes. With typical New England ingenuity, the Sauer Brothers and Howard Kilborn are part and parcel of the operating set-up and a vital hard working unit of the busi-

Part of the Kilborn-Sauer factory where power is made for less by Diesel Engines.



Interior of the engine room at Kilborn-Sauer showing the two Fairbanks-Morse Diesels. Switchboard is in background with Alnor pyrometer on bottom panel.

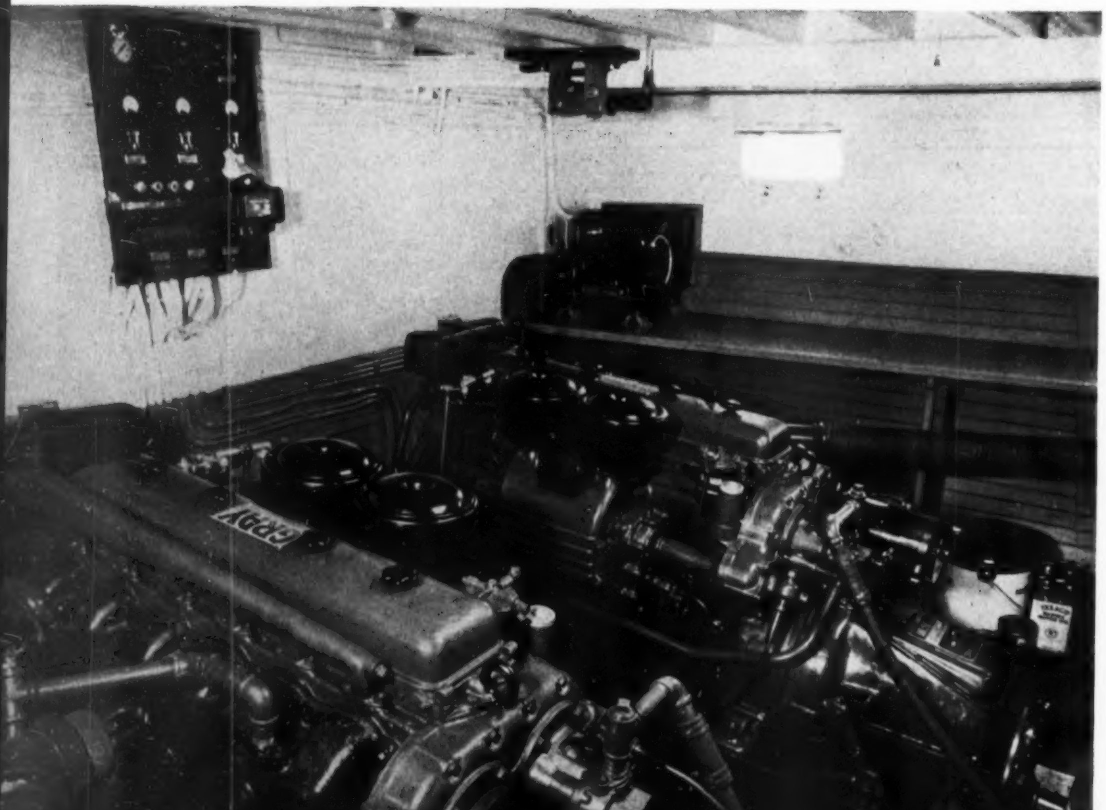
ness. The complete production, assembly, boxing and shipping is carried on within the one building.

The Kilborn-Sauer plant itself, is rather deceptive in appearance, and a comparatively small front does not give visitors the true indication of the size, scope and manufacturing facilities within. Indeed, increased production through the years has necessitated additions to various parts of the original plant. Broadening out on both sides, it is complete with power presses, automatic buffing machines, plating machines, etc. The business, employing over 100 men is really non-seasonal (though the press of production increases during January through July) and presents a steady load for five days of the week throughout the year.

Fairfield, with emphasis on home rather than industry, and its yearly influx of summer visitors, would naturally present a noise problem to many plants. Despite the fact, however, that Kilborn-Sauer is adjacent to the residential district, its quiet operation denotes the success of Diesel equipment. Today, Kilborn-Sauer is thoroughly convinced that Diesels offer the answer to the problem of securing power at rock-bottom cost. The genuine enthusiasm demonstrated by this firm over the operation of Diesels and their sincere conviction of both its increased efficiency and greater economy makes a convincing picture, indeed.

The Fairform transoceanic yacht which is powered with a pair of Gray Marine Diesels illustrated below.

THE FAIRFORM FLYER



A NEW Fairform Flyer Diesel yacht designed and built by Huckins Yacht Corporation of Jacksonville, Florida, recently added an interesting chapter to yachting lore. This thoroughly seaworthy craft, measuring 60 ft. x 16 ft. 5 in., with a 4 ft. draft, undertook the extremely hazardous voyage from Jacksonville to Los Angeles, California, via the Panama Canal. Never before has this trip been undertaken by a power boat under 90 ft. long. A single, non-stop run of 2,265 nautical miles was made on this trip.

The Fairform Flyer is powered with a pair of Gray Marine Diesels which are built by General Motors and adapted for marine use by Gray Marine Motor Company. The Diesels are carried on steel beds isolated from the bulkheads by Fairform Floating Bed Mountings. This combined with acoustical treatment has accomplished a silence and smoothness equal to that of a steamship. Driving through a 1.5 to 1 reduction gear, she achieves a maximum speed of 14.5 knots and an average sea speed of 12 knots.

With fuel tanks full to their capacity of 2,070 gallons, she has a radius of 1,800 nautical miles, cruising at 12 knots. At a speed of 8 knots, her radius is 4,800 nautical miles—sufficient to cross the Atlantic or Pacific Oceans.

Built especially for transoceanic cruising, the Fairform Flyer is capable of outliving not only storms, but hurricanes at sea.

HARRISONVILLE, MO.

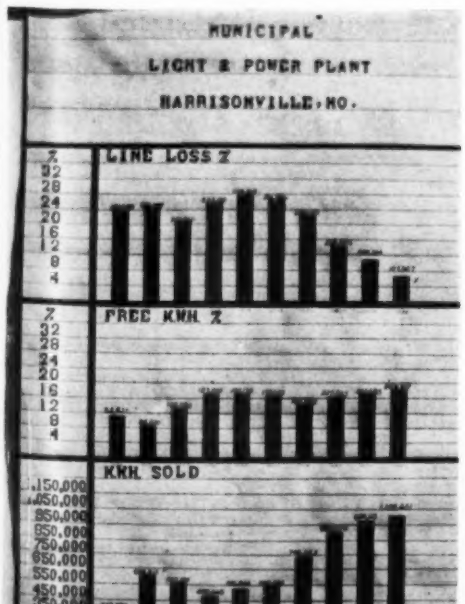
By R. D. CAMPBELL

HARRISONVILLE, Missouri, has recently completed ten years of operation of its municipally owned Diesel electric power plant. During this decade of municipal ownership Harrisonville has made an enviable record with its plant and has shown what can be done with a municipal plant that is managed carefully. The expression "well managed" is not idle talk as evidenced by the production of more than 12 kw. hours per gallon of fuel, and a total production cost of less than 3/4 cent per kw. hour.

Located forty miles south of Kansas City, Harrisonville is the county seat of Cass County. The 1930 census showed a population of 2,306, and even its Chamber of Commerce does not claim more than 2,500 population today—that will give an idea of its size. It is a typical small town in an agricultural region with its industries limited to an ice plant and a small mill.

Harrisonville's first municipal power plant was installed in 1900 and was equipped with steam power. The plant proved to be a liability for its operating balance was always "in the red." In 1918, the steam power plant and distribution system was leased to a utility company for a period of ten years. This move proved very unpopular due to the increase in rates charged for electric current. When the lease expired in

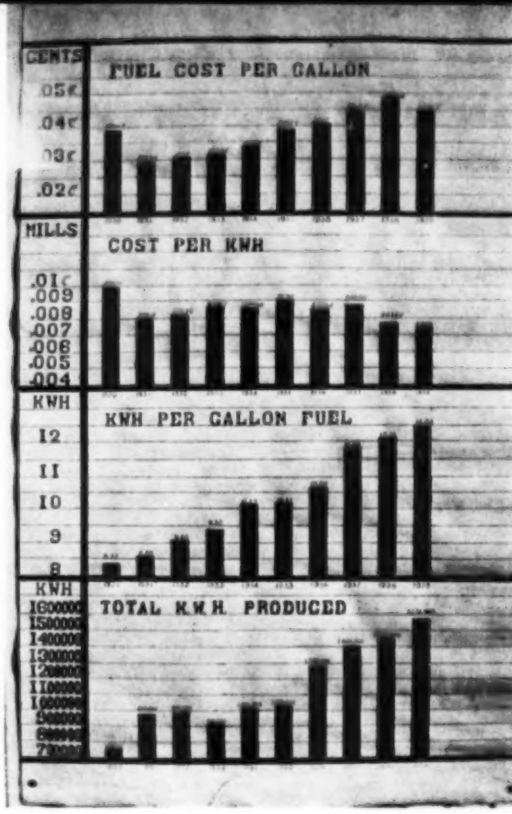
This chart illustrates the growth of revenue during the years 1930 through 1939.



1928, steps were taken to purchase Diesel engines. In March, 1930, Harrisonville began operating its own Diesel engine powered municipal plant. The new equipment was purchased with the proceeds from revenue bonds, the principal and interest on the bonds to be paid from the net proceeds of the plant. No general tax levy bonds were used in negotiating the transaction. The original generating equipment consisted of two six-cylinder, 360 hp. Type Y-VA Fairbanks-Morse Diesel engines direct connected to 240 kw., 3 phase, 2400 volt, 60 cycle Fairbanks-Morse alternators.

The two units mentioned above were the only generating units in the plant until the summer of 1936, when a third Diesel engine generator was installed. And here is another example of good management. A study of the daily load curves showed that for several hours each day the load was between 150 and 190 kw. They also did not have any mistaken ideas that Harrisonville was to experience any rapid growth in population. The result was that in the summer of 1936 a smaller but well chosen unit was installed. The third and last unit consists of a four-cylinder, 300 hp., Model 32E14, Fairbanks-Morse two-cycle Diesel engine direct connected to a 200 kw. Fairbanks-Morse alternator of the same electrical characteristics as the first two units. The wisdom of this selection was proven during the first year of its operation when it produced 12.42 kw. hours per gallon of fuel oil and was used so much of the time that it raised the average of the entire plant from 10.67 kw. hours to 11.7 kw. hours per gallon. This remarkable improvement in economy was in part due to the better economy of the newer type of engine, and partly due to the fact that the engine was of the proper size to handle the load economically.

In keeping with the program of economical operation, it was decided to operate the city water pumps at such times as this increment of the load could be handled economically. The city water pumps are tended by the engine operators, and as there is an elevated water tank to store the water it is possible to stop the pumps when the load approaches the capacity of the engines in operation and to start up the pumps as the load decreases and the engines



This chart emphasizes load growth and consistent reduction of cost per kwh. for the years 1930 through 1939.

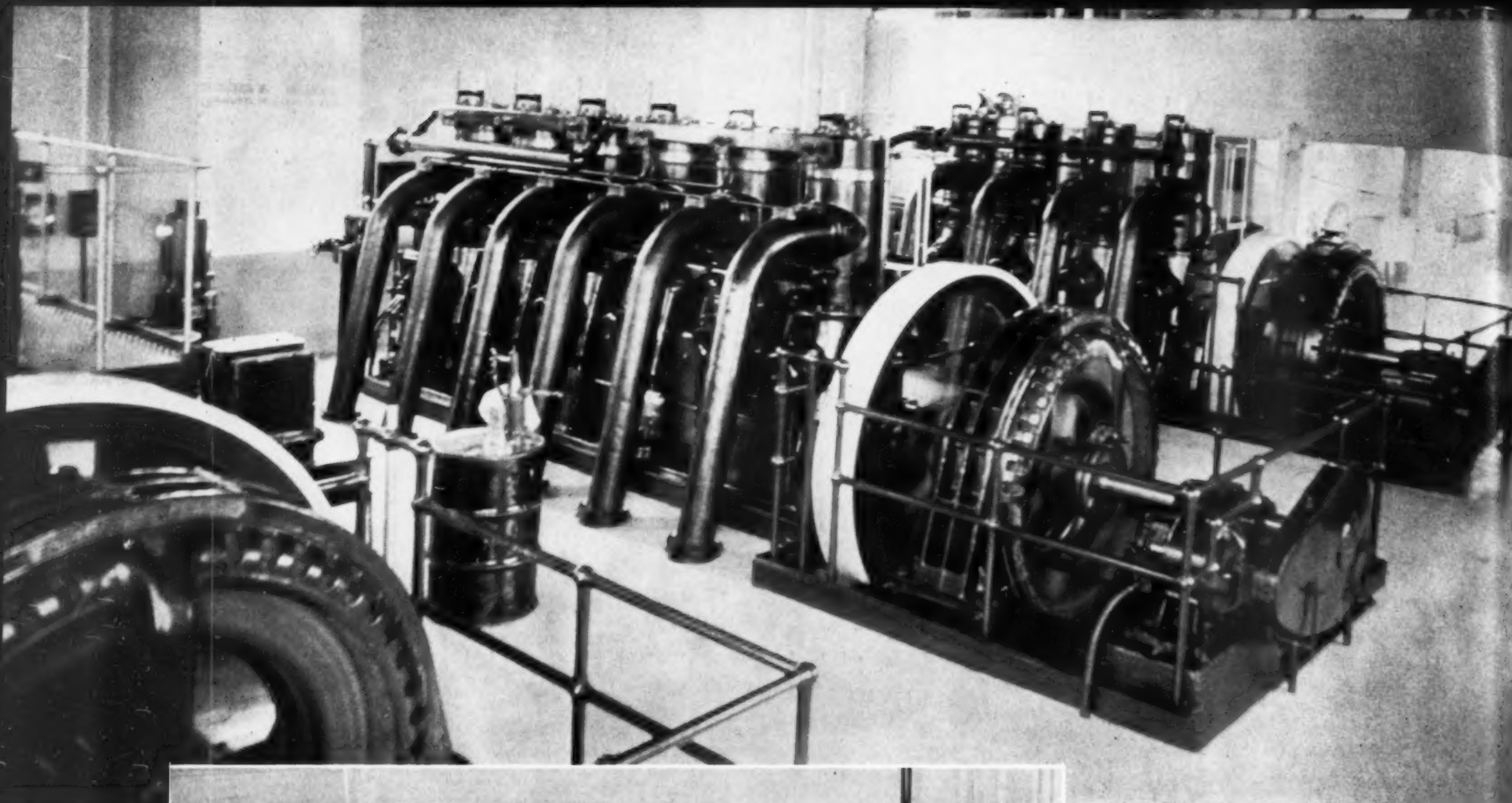
can handle the added load of the pumps. The proper handling of the city water pumps has been another important factor in improving the engine economies by increasing the running engine capacity factor.

The original engines were of the two-stage combustion chamber design with a solid injection fuel nozzle. Because of the superior fuel economy demonstrated by the new engine which has open type combustion chambers and differential injection nozzles, it was decided to modernize the original equipment by installing the newer combustion arrangement. This program requires that new pistons, cylinder heads and injection nozzles be installed on each of the two older engines.

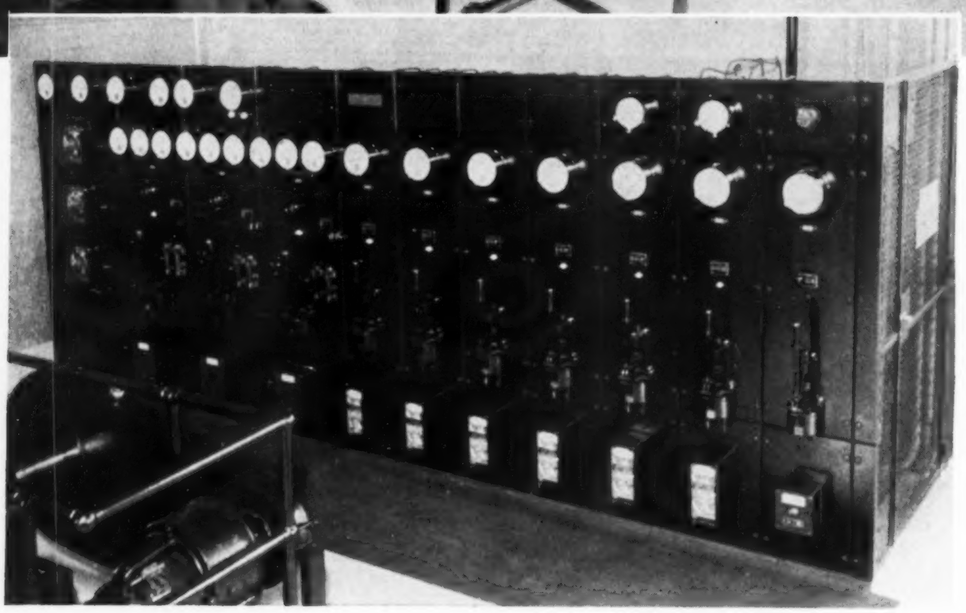
The procedure or system of purchasing and handling the fuel and lube oil requirements for the plant plays an important part in maintaining the low production costs shown in the table. The fuel is purchased on a yearly contract basis as a result of bids on a fuel to meet the following specifications and delivered on the terms outlined below:

FUEL OIL SPECIFICATIONS AND TERMS

	Maximum	Minimum
Gravity, °API	30	20
Cetane Number		40
Carbon Residue, % by wt.	0.05	
Sulphur, % by wt.	0.5	



General engine room view with the new 300 hp. Fairbanks-Morse engine in the background.



The main switchboard, shown here, consists of one control panel, 3 engine panels, 6 distribution panels, and 1 station panel.

B. S. & W., % by vol.	0.05	
Flash, C. O. C., °F	250	150
Fire, C. O. C., °F	280	180
Pour Point, °F	0°F on 30,000 gal.	
Pour Point, °F	30°F on balance	
End Point, °F	700	
Recovery, %		99
Viscosity, SSU @ 100°F	80	40
Heat Value, BTU/lb.		10,000

"The fuel to be 100% overhead product and shipped freight prepaid in clean tank cars. The city reserves the right to test any car of fuel before it is unloaded and to reject it if it fails to meet specifications. The price quoted is to be a flat price for the year, quoted in cents per gallon delivered, the contract to require a minimum of 100,000 gallons and a maximum of 120,000 gallons during the year."

The fuel storage consists of two 17,500 gallon horizontal steel tanks located directly behind the plant building. The fuel is pumped to overhead day tanks which supply the engines. As the fuel flows from the day tanks to the engines, it is passed through a Midwest Fuel Filter. This precaution is taken in spite of the fact that only clean fuel is purchased and it is stored and handled with the utmost care. Such measures, however, seem to be justified, for the plant has no fuel pump and nozzle problems and, when the two older units were modernized recently after nearly ten years of service, the maximum cylinder wear (which is in the upper part of the ring travel) ranged from .016" to .026" in the twelve cylinders involved. No new cylinders were needed after each engine had run 40,000 hours—so there must be something to this idea of carefully handling and filtering the fuel oil.

Branded lubricating oils supplied by reputable refiners have always been used in the engines. The oils must be suitable for use in this particular type of engine and meet the following general specifications:

LUBRICATING OIL SPECIFICATIONS

	Maximum	Minimum
Color, N. P. A.	3½	
Pour Point, °F	−10	
Flash Point, °F	500	380
Fire Point, °F	550	430
Viscosity, SSU @ 130°F	250	150
Viscosity Index, D & D		70
Viscosity, SAE	30	20
Gallons required	1,800	1,200

"All companies to quote on their first line of Diesel lubricating oils, that is, within above specifications."

After selecting a good lubricating oil, it is kept in good condition by a continuous filtering

Exterior of the Harrisonville, Mo., plant. Fuel storage tanks and cooling tower are seen at the left.

process. Each engine is equipped with a Midwest Lubricating Oil Filter which is operated at all times that the engine is operating. Shell Oil Company's TALPA Diesel Engine Oil is used in all engines in the plant.

Reliability and continuity of service are characteristics of the Harrisonville plant. The total time of service interruptions in the ten-year period totals only 73 minutes. The maximum duration of any interruption was ten minutes and this occurred at 2:30 A.M. one morning in 1934. This is truly a fine record for an isolated plant in an area frequented by "twisters," lightning, and severe weather conditions.

Harrisonville had a total of 931 customers receiving electric service as of January 1, 1940. They were divided as follows: Residential 596, Commercial 214, Industrial 21.

The plant is arranging to supply electricity to a Rural Electrification project which will increase the total number of customers supplied by this plant.

The present schedule of rates for electric service is as follows:

RESIDENCE
- First 30 kwh. per month @ 9c
- Next 70 kwh. per month @ 3c
- All additional per month @ 2c
- Minimum monthly charge $1

BUSINESS
- First 50 kwh. per month @ 9c
- Next 50 kwh. per month @ 5c
- All additional per month @ 3c
- Minimum monthly charge $1

POWER
- First 250 kwh. per month @ 5c
- Next 500 kwh. per month @ 4c
- Next 1,000 kwh. per month @ 3c
- All additional per month @ 2c

There is a special rate for show windows and displays which is on a separate unmetered circuit controlled from the plant. This circuit is turned on at dark and off at midnight, and throughout the year averages 188 hours of service per month. The price for this service is 45 cents per month for each 100 watts of lights. As a 100 watt bulb would consume 18.8 kwh. during the average month, this rate figures slightly less than 2½ cents per kwh. with the plant personnel responsible for turning the lights on and off.

The book value of the electric plant and distribution system is $153,000, although the actual replacement value of this equipment is probably much nearer the $200,000 figure. Granting that either figure is the present value of the system, it earned over $24,000 for the city—which is a nice return on any investment! Here is the way the receipts and expenses look for the calendar year 1939:

Operating Revenue, Sales of Electricity		$44,223.19
Operating Expense, Electricity		
Production		
Labor	$3,132.18	
Fuel Oil	5,689.00	
Lubricating Oil	741.80	
Station Supplies	742.18	
Plant Maintenance	737.23	
Engine Maintenance	574.36	
Total Prod. Exp.	$11,616.75	
Distribution		
Operating Dist. Line	1,829.80	
Maintenance Line	1,878.45	
Utilization Expense	727.82	
Commercial Expense	1,470.53	
Administrative Expense	226.00	
Bad Accounts	128.61	
Interest on Engine	780.00	
Insurance	1,200.00	
Total Dist. Exp.	$8,241.21	
Total Electric System Expense		$19,857.96
		$24,365.23

The figures have not always shown such a large profit, but for several years the plant personnel has been striving for lower production costs. Line losses and production costs have been reduced while the kw. output per gallon of fuel has risen steadily. Besides the actual dollar profits listed above, the electric plant furnishes current free to the City Hall, rock crusher, street lights, water pumps, and other municipal uses. The free service supplied to the other departments of the municipal government average 15% to 18% of the total power produced.

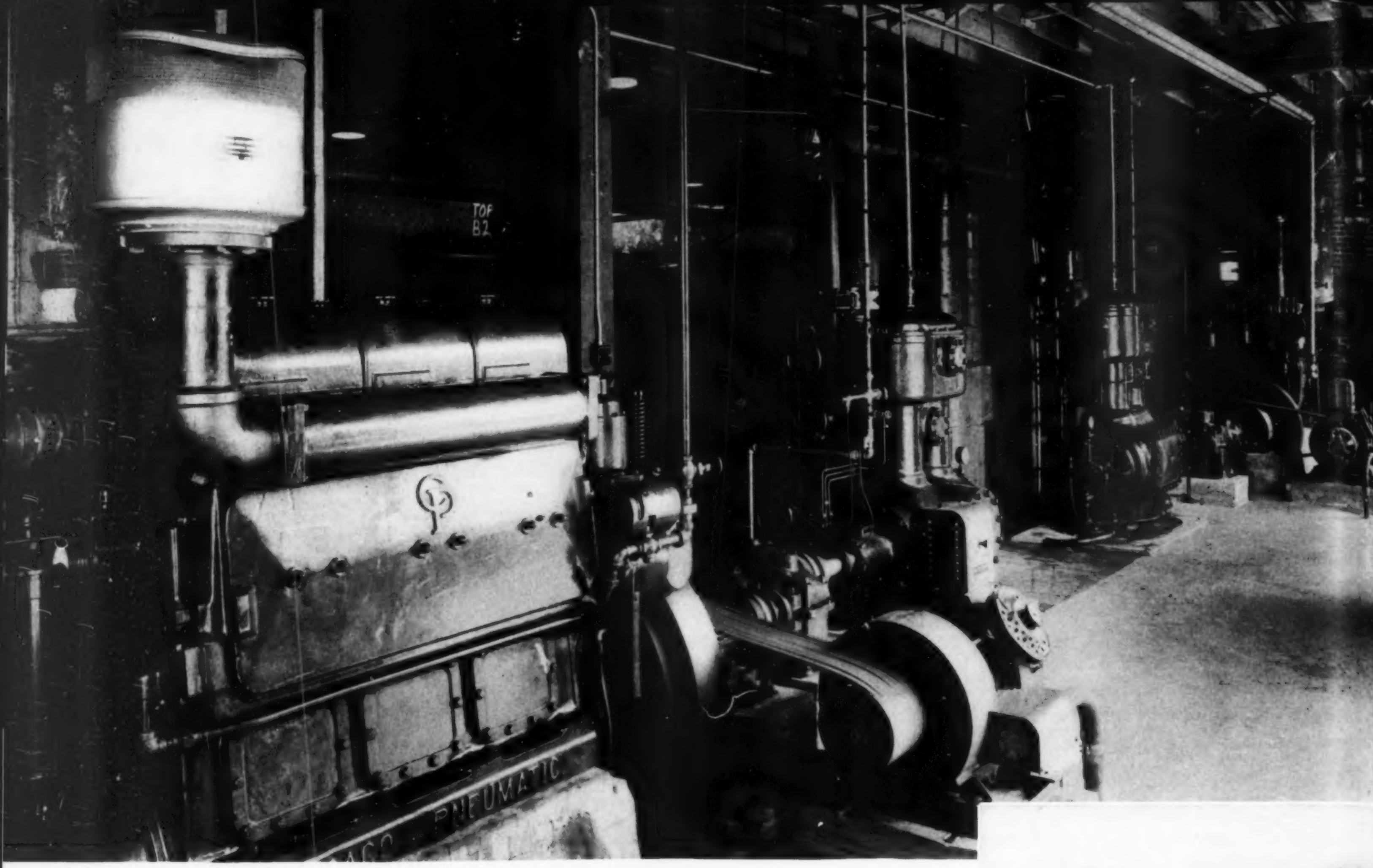
During the past ten years the rates charged for electricity have been reduced several times. To date there has been no special effort made toward building the load on the plant. As the load increases it is anticipated that further rate reductions will be made. The present rates compare favorably with other towns of the same size throughout the Midwest.

The progress shown by the Harrisonville plant is not an accident! It did not just happen, it was planned, and the plan and its execution required some effort—but it was worth it! We asked Mayor James D. Idol to give us a statement on municipal power plants and here is what he had to say:

"Municipal utilities are, and must be managed like any successful private business. Full responsibility must be placed on an efficient and capable superintendent and he must be given the necessary authority to operate. Further, he should be held responsible for the success of the business. It is impossible for a board of laymen to determine the needs of a complicated mass of machinery and they should not try. Policy only should be determined by the board or council in whose charge the utility is placed. Worst of all would be the selection of personnel for political reasons.

"There is good and sufficient reason for the operation of municipal utilities if they are conducted in a business-like fashion. Operated first to give real service at reasonable rates and second for the general improvement of the community they can be any city's first asset."

Missouri has long been known as the "show me" state because of the reputed skepticism of its people. Harrisonville, however, is one part of the state that is doing an excellent job of showing others what can be done with a well-managed municipal Diesel plant. And the results reported here did not "just happen" in Harrisonville. Instead of making the common mistake of buying blindly and ending up with off-size units, the city officials and plant superintendent made careful studies of their requirements and then bought units which met the conditions most economically.



The Tuckahoe Ice Company Diesel installation at Tuckahoe, New York.

A NEW DIESEL ICE PLANT

By GEORGE D. CROSSLEY

NOWHERE in the broadening field of Diesel applications is the miracle of the transformation of heat energy into its opposite more poignantly demonstrated than in an ice plant—especially on a day in August. To go directly from the presence of throbbing heat engines and atmospheric temperatures reaching the 100° mark into the adjacent storage rooms where the still cold of a January night always prevails and to recall that this is accomplished through the application of modern mechanics to long known and comparatively simple natural laws is to realize anew that here is a miracle, indeed.

Diesel engines have been definitely invading the ice manufacturing industry over a period of years because the unmatchable efficiency of the Diesel prime mover has enabled operators to meet the rising tide of competition and because Diesels are compact and flexible.

For instance with the advent of the new Diesel ice plant of the Tuckahoe Ice Company in the heart of Westchester County, New York, prices throughout the zone of influence of this plant were dropped 50%. But this drastic competitive move did not dismay Mr. Herbert Evans, who, after many years of experience in all phases of the ice business and who now heads up the Tuckahoe plant, knows that his Diesel engines will give him operating costs low enough to meet all comers.

This 60 ton plant, built entirely to Mr. Evans' plans, is especially arranged to function with the minimum of labor. In fact, it is possible for one man to perform all of the operations required in the actual production and storage of ice. As an example of the careful planning of details, the engine floor is flush with the freezing tank floor which greatly facilitates servicing the tanks and machinery.

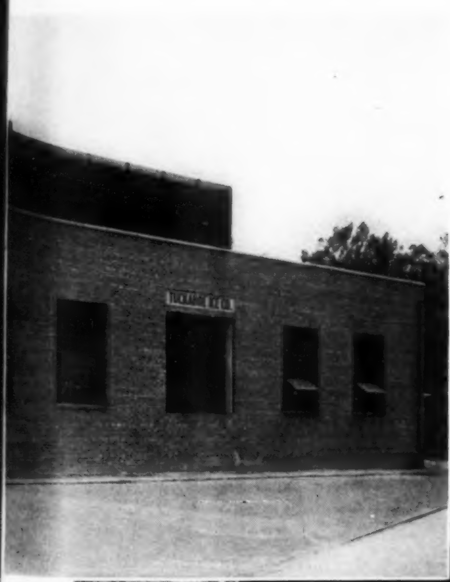
All power for freezing, refrigeration of storage, electric motors and lighting is supplied by two Chicago Pneumatic Diesels. These engines are 4 cycle, 3 cylinder, 9" bore, 10½" stroke, rated 142½ hp. at 720 rpm. Connected through Thomas flexible couplings on each side of Farrell herringbone reduction gears are Frick compressors and V-belted to each engine shaft is an Electric Machinery 30 kw. alternator with built-in voltage regulator and control. The switchboard carries an E. M. Co. automatic synchronizer. Thus, either engine-compressor-generator unit may be operated singly or the two units may be operated in step.

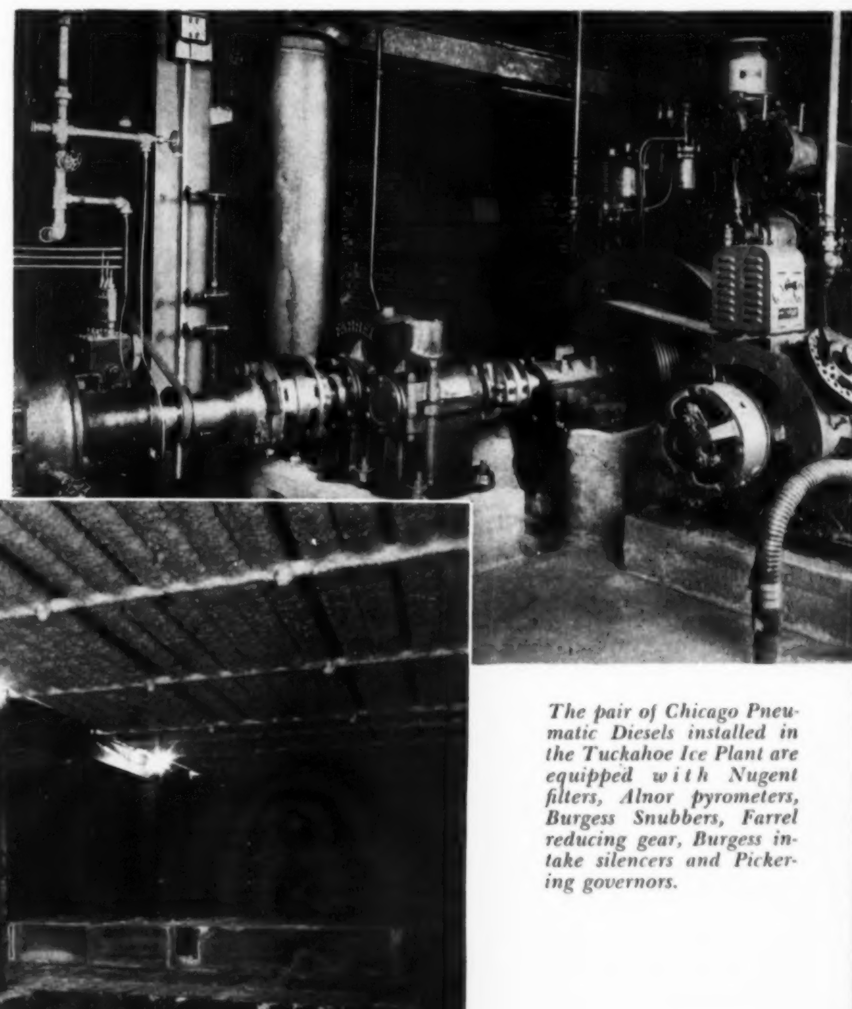
Full protection for the engine lubricating oil, which is Texas, is provided with Briggs Clarifiers. Further protection is assured by an Alnor exhaust pyrometer on each engine. Gross lube oil coolers are fitted to the lubricating system of each engine. A Fulton-Sylphon low oil pressure and high water temperature automatic stop is fitted to each engine. Built-in pumps bring fuel oil from the 2000 gal. underground storage tanks to the engines where it is passed through Nugent filters before injection. A Levelometer distant reading tank gauge, mounted on the engine room wall, indicates the amount of fuel in storage in gallons. The engine governors are Pickering.

Thorough silencing is a vital necessity in this plant due to its location directly across the street from residences. Burgess Snubbers on both intakes and exhausts are proving satisfactory under these exacting conditions. A Marley combination closed jacket water copper tube cooler and tower is mounted on the roof alongside the larger condenser cooling water tower of the same make. A Wisconsin gas engine driven Quincy compressor mounted in the basement supplies starting air for the engines. The entire power equipment represents good engineering in selection, and arrangement with emphasis in every detail on economy and overall efficiency of operation.

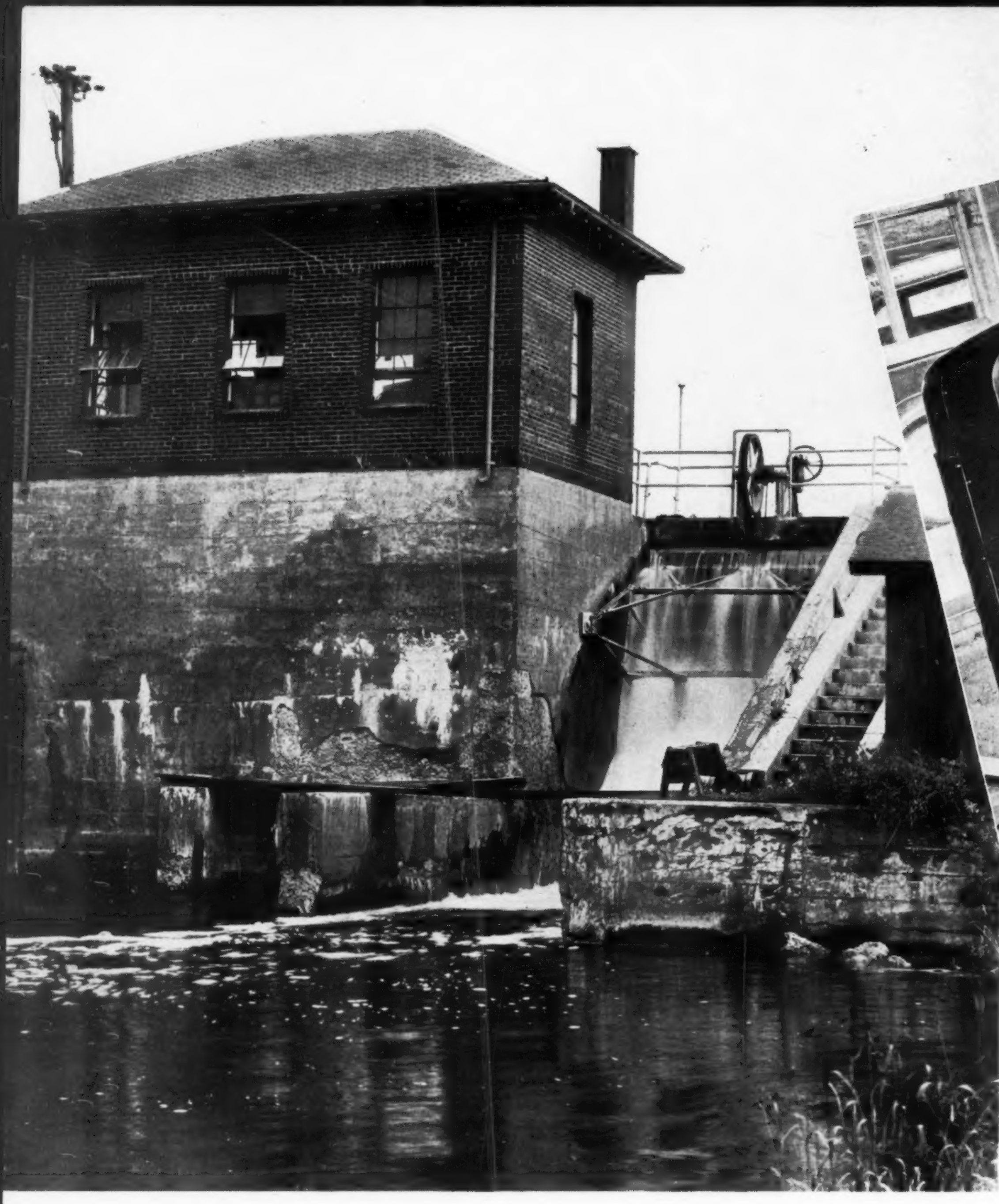
One of the newer phases of the ice business is that of furnishing cubes to the trade. Several methods of making cubes are in use, including that of sawing large blocks of ice into cubes. But in this plant there is a simple device which melts cubes from solid blocks. It consists of two sets of fine chromium plated copper tubes connected to headers and placed at right angles so that one set of tubes cuts through the ice block horizontally, the other set vertically, thereby producing perfect transparent cubes. The heat to perform this operation is supplied from the Diesel engine jacket water.

The Tuckahoe Ice Company built this new, modern plant last winter and started to produce ice in April. Too soon, now, to put down any overall operating cost figures—there have been a very few ice absorbing weeks this summer—but Mr. Evans knows that his costs with Diesels will enable him to meet all competition; all he needs for real profit is volume and he also knows he will get that.





The pair of Chicago Pneumatic Diesels installed in the Tuckahoe Ice Plant are equipped with Nugent filters, Alnor pyrometers, Burgess Snubbers, Farrel reducing gear, Burgess intake silencers and Pickering governors.



The old Bellaire, Michigan power house and water wheel, which turns a 100 kw. 2,300 volt alternating current generator, previously supplied all the electric energy for the community. It is located on the Cedar River a half mile or more from town.

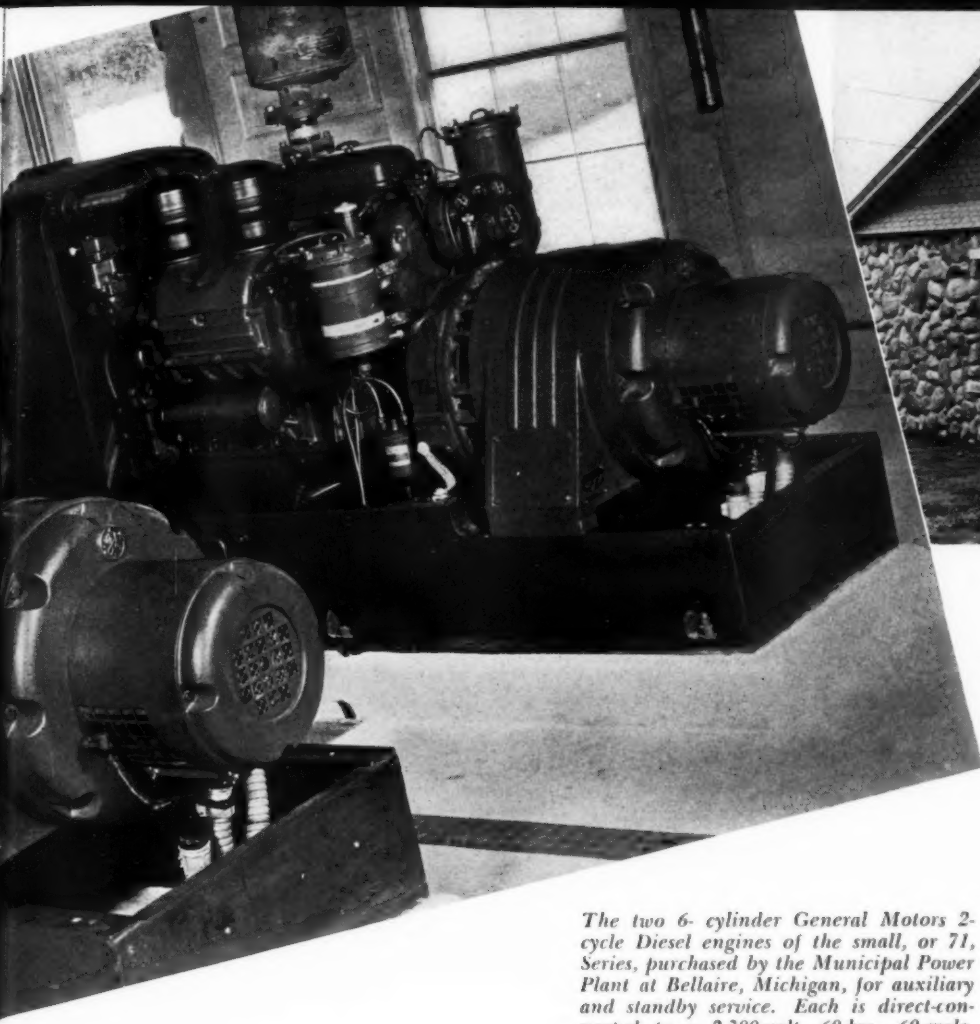
BELLAIRE, MICHIGAN

By GEORGE D. CROSSLEY

RESIDENTS of Bellaire, Michigan, in the heart of the Grand Traverse Bay resort section, are easier to live with these days.

Housewives no longer worry about fallen cakes; the barber now can offer you a dry shave; ten or more kerosene, coal, and wood ranges have given way to bright, new, shiny electric stoves; and there is a continual supply of hot water in homes blessed with electric water heaters. Even the dentist is happy, if not the patient in his chair, for he knows there is little likelihood that the motor powering his drill will burn out, due to fluctuating voltage, while excavating that big cavity.

All this has come about through the acquisition by the village of two 6-cylinder, General



The two 6- cylinder General Motors 2-cycle Diesel engines of the small, or 71, Series, purchased by the Municipal Power Plant at Bellaire, Michigan, for auxiliary and standby service. Each is direct-connected to a 2,300-volt, 60-kw., 60-cycle, three-phase alternating current generator. Both Diesels are equipped with synchronous governors.

The new power house of field stone construction that has been erected at Bellaire, Michigan, to house the General Motors 2-cycle Diesels which are used for auxiliary and standby service.

Motors 2-cycle Diesel engines of the small, or 71, Series.

There is no gas in the area. Electrical energy previously was supplied solely by a water wheel on the Cedar River, half a mile or more from town, that turns a 100-kw., 2,300-volt alternating current generator.

It is equipped with a governor, but with the passing of years the parts of this expensive mechanism wore to the extent that current, supplied the municipality, stepped down to 110 volts in its passage through transformers, fluctuated as much as 5 volts and varied from 55 to 65 cycles, making cooking by electricity extremely difficult and the operation of fractional horsepower motors almost impossible, not to mention the annoyance caused by the dimming of lights throughout the community.

The situation was aggravated in the summer months by the influx of visitors that swells the population of the area served by the municipal power plant from a normal of 580 to 1,200. Coupled with this is the fact that water in the river ordinarily is lower in the summer than at any other time of the year.

Village officials solved the problem by the purchase of two General Motors Diesels for auxiliary and standby service. These are direct-connected to 2,300-volt, 60-kw., 60-cycle, 3-phase alternating current generators.

Exploding the long accepted theory that generators in the same circuit must be operated at comparable speeds, those of the "Packaged Power" units are hooked up in parallel with the water wheel generator. While the latter turns only 240 rpm., the Diesels are run at 60 cycle synchronous speed of 1,200 rpm.

For the past few years, major repairs to the hydro plant have been sadly needed, but due to a lack of any other source of stand-by, it was impossible to shut the wheel down to complete repairs. The dependability of Diesel generators has been such that in the middle of the summer, during the height of the tourist season, the city officials have felt safe in shutting down the water wheel for these repairs, depending entirely upon the two Diesel generators to carry the entire load of the village.

The operation of the two units, once they are started and on the line, is entirely automatic, and they do not keep a regular attendant at the power house except to start and stop the generators.

Fuel consumption figures, even with the varying loads, are highly satisfactory. Records kept by the municipality show that an average of 11 kw. are being produced for every gallon of fuel oil burned by the Diesels.

A new 24′ x 36′ power house of field stone construction has been erected to house the Diesel units. Though located in a residential section near the center of the village, there has yet to be a complaint from those living in the vicinity. Silencers effectively smother the noise, while the clear exhaust characteristics of General Motors Diesels, of course, are well known wherever these engines are used.

Space is provided in the power house for the installation of a third "Packaged Power" unit should it become desirable. The structure also houses a rotary pump of 350 gpm. capacity that handles the village water supply. Operated by a 30 hp. electric motor, it draws water from an artesian well, pumping it into a 50,000-gallon reservoir.

The installation was made by the Wolverine Diesel Power Company, of Detroit, distributor of the General Motors line of 2-cycle Diesel engines in lower Michigan peninsula.

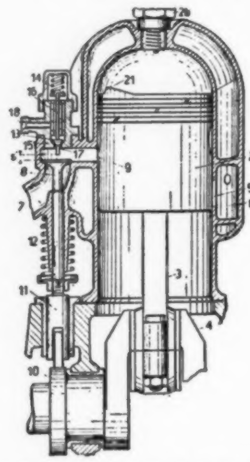
Latest Diesel Patents

A description of the outstanding patented inventions on Diesel and Diesel accessories as they are granted by the United States Patent Office. This information will be found a handy reference for inventors, engineers, designers and production men in establishing the dates of record, as well as describing the important Diesel inventions.

Conducted by C. CALVERT HINES*

2,177,020
CHARGING OF EXPLOSION ENGINES
Ottavio Fuscaldo, Milan, Italy
Application April 22, 1938, Serial No. 203,482
In Italy April 26, 1937
6 Claims. (Cl. 123—65)

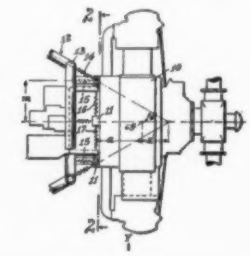
1. Charging means for an overfed explosion engine of the two-stroke-cycle kind which has a cylinder with a piston therein and inlet and exhaust cylinder ports together with means whereby said ports are so uncovered and covered by the piston movements that the inlet opens shortly ahead of the exhaust on the power stroke and they close in reverse order on the return stroke; the same comprising a mixing chamber delivering to the inlet port, an air valve admitting compressed air to the chamber, a fuel valve admitting liquid fuel with forced flow to the chamber under pressure higher than the air pressure, and valve mechanism timed with the piston movements and coordinating the air and fuel valves, whereby (*a*) the air valve is opened shortly before the piston closes the exhaust port thus expediting scavenging, and remains open substantially until the inlet port is closed by the piston, while (*b*) the fuel valve is opened only after the piston closes the exhaust port, and while the air valve and inlet port are both open, and remains open for only



a predetermined portion of the period during which the air valve and inlet port both remain open.

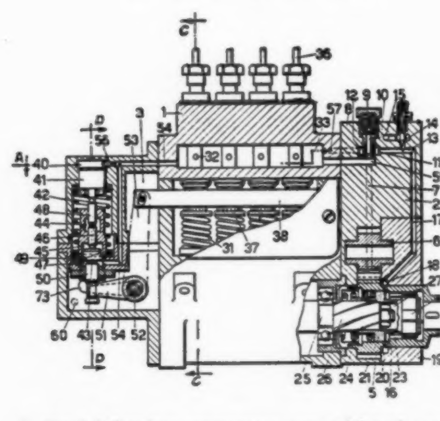
* Patent Attorney, 811 E. Street, N.W., Washington, D. C.

2,175,999
FLEXIBLE ENGINE MOUNT
Edward S. Taylor, Cambridge, Mass., assignor, by mesne assignments, to Wright Aeronautical Corporation, Paterson, N. J., a corporation of New York
Application July 23, 1937, Serial No. 155,174
20 Claims. (Cl. 248—5)



1. In an elastic mounting system, a vibratory body including a point at which the body is desired to be virtually supported, a mounting structure, and a plurality of elastic mounting devices lying substantially in a plane spaced from the body center of gravity and connecting said structure and said body, said devices including principal axes A and B along which the devices have respectively relatively high and low spring rates, said devices being so disposed that the axes A intersect at a point more remote from the mounting devices and on the same side thereof relative thereto as the point of virtual support of said body.

2,177,120
FUEL INJECTION APPARATUS
Ernst Schaeren, Soleure, Switzerland, assignor to Scintilla, Ltd., Soleure, Switzerland, a corporation of Switzerland
Application August 31, 1937, Serial No. 161,858
In Switzerland September 9, 1936
10 Claims. (Cl 123—139)



1. Fuel injection apparatus comprising in combination an injection pump body having a fuel supply chamber and a second fuel chamber formed therein, injection pump means in said injection pump body adapted for drawing fuel out of said fuel supply chamber, a feeding pump body having a delivery chamber, an auxiliary chamber, ports connecting said delivery chamber to said auxiliary chamber, and a restricted outlet passage issuing from said auxiliary chamber formed therein, said feeding pump body being affixed to one side of said injection pump body, said delivery chamber in said feeding pump body communicating with said fuel supply chamber in said injection pump body and said auxiliary chamber in said feeding pump body communicating with said second fuel chamber in said injection pump body, feeding pump means in said feeding pump body adapted to pump fuel into said delivery chamber, a pressure regulating device

adapted to control said ports in accordance with the pressure in said delivery chamber, a governor body having a servomotor cylinder and a control cylinder formed therein, a servomotor piston slidably fitting said servomotor cylinder so as to bound therein a servomotor chamber, a control piston slidably fitting said control cylinder so as to bound therein a control chamber, said governor body being affixed to the opposite side of said injection pump body, said servomotor chamber communicating with said fuel supply chamber and said control chamber communicating with said second fuel chamber in said injection pump body.

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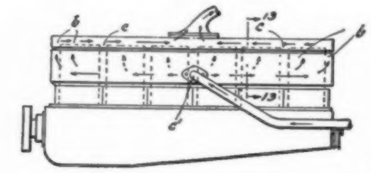
2,175,448
ENGINE COOLING SYSTEM
Hermann Schlagintweit, West Orange, N. J.
Application March 5, 1937, Serial No. 129,127
1 Claim. (Cl. 123-173)

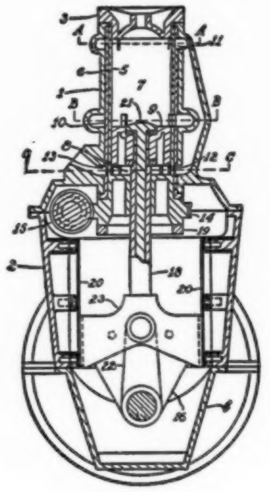


In a cooling system for an internal combustion engine, a cylinder block, a cooling jacket, a pipe conduit for feeding the cooling medium to the cooling jacket of the cylinder block, a partition wall in said jacket to direct the flow of the cooling medium in opposite directions, a discharge channel for the cooling medium divided by said partition, and oppositely disposed to said pipe conduit, and conduits in the cylinder head in communication with said jacket to direct the flow of the cooling medium in opposite directions towards said discharge channel at both sides of its partition.

21,219
TWO-CYCLE ENGINE
Calvin D. Quantz, Detroit, Mich.
Original No. 2,061,439, dated November 17, 1936, Serial No. 69,968, March 20, 1936. Application for reissue October 21, 1938, Serial No. 236,306
3 Claims. (Cl. 123—74)

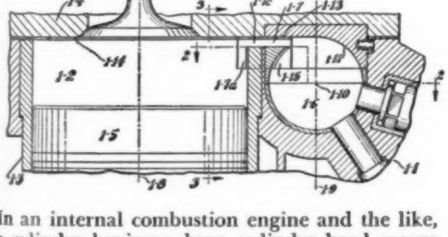
1. In the combination of a two-cycle engine, a crank case, a cylinder block mounted on the crank case, a rotary sleeve valve operating within said cylinder block, said sleeve valve consisting of a pair of cylinder sleeves, one sleeve being stationary, the other revolving within the stationary sleeve, said revolving sleeve having an inclosed base except for a hole for the insertion of the connecting rod, a vertically reciprocating connecting rod passing through said hole, said hole being air tight when the said connecting rod is inserted therein, thus preventing fuel leakage from the charging chamber, a piston fastened to the connecting rod, said piston operating within the revolving cylinder sleeve, said piston in the cylinder forming two chambers therein, a combustion chamber above said piston, a charging chamber below, the charging chamber formed between the piston and the inclosed base of the revolving sleeve, annular slots in the upper end of said sleeve to control the inlet ports of combustion chamber, annular slots in said sleeve

at the lower end of the combustion chamber to control the exhaust ports for said chamber,



the slots of the revolving sleeve for the charging chamber being annularly spaced to correspond with said inlet and exhaust ports of the combustion chamber, said slots serving a dual purpose by controlling inlet and outlet ports in the charging chamber, said stationary sleeve having the inlet and exhaust slots for the combustion chamber annularly spaced to correspond with those slots of said revolving sleeve, the said stationary sleeve having a pair of oppositely spaced slots forming inlet and outlet ports in the charging chamber when coinciding with those slots of the revolving sleeve.

2,172,526
INTERNAL COMBUSTION ENGINE WITH CYLINDER CHAMBERS AND WHIRL CHAMBERS AND CONNECTING PASSAGEWAYS
Otis D. Treiber, Canton, Ohio, assignor to Hercules Motors Corporation, Canton, Ohio, a corporation of Ohio
Application February 7, 1938, Serial No. 189,078
1 Claim. (Cl. 123—32)



In an internal combustion engine and the like, a cylinder having a bore, cylinder head means having an inner face extending across one end of the cylinder bore, a piston operating in the cylinder bore and having an end face opposite the cylinder head means inner face and forming therewith and with the cylinder bore a cylinder chamber, walls forming a whirl chamber adjacent the cylinder chamber, and walls forming a plurality of passageway channels providing communication between the cylinder chamber and the whirl chamber, each passageway channel having a plurality of inner faces angular with respect to each other, and each channel face extending between the cylinder chamber and the whirl chamber.

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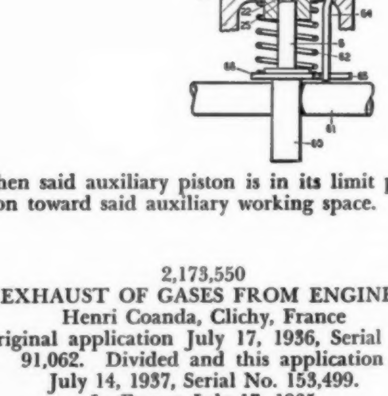
2,173,813
FUEL INJECTION APPARATUS
Bernhard Bischof, Winterthur, Switzerland
Application October 20, 1937, Serial No. 170,114
In Switzerland October 20, 1936
22 Claims. (Cl. 123—139)

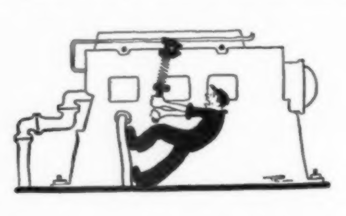
1. Fuel injection apparatus comprising in combination an injection passage; a pump cylinder and reciprocable piston enclosing together a pump working space, said pump cylinder having a fuel inlet port communicating with said working space and a delivery port through which said working space communicates with said injection passage; an auxiliary cylinder having an outlet port; an auxiliary piston shiftable in said auxiliary cylinder and separating in said auxiliary cylinder an actuating space communicating with said pump working space and with said outlet port, and an auxiliary working space communicating with said injection passage; an abutment for limiting the travel of said auxiliary piston toward said auxiliary working space; inlet valve means associated with said pump piston for controlling said inlet port; and delivery valve means responsive to pressure in said pump working chamber for controlling said delivery port, outlet controlling means associated with said auxiliary piston for controlling said outlet port so that the latter is open



when said auxiliary piston is in its limit position toward said auxiliary working space.

2,173,550
EXHAUST OF GASES FROM ENGINES
Henri Coanda, Clichy, France
Original application July 17, 1936, Serial No. 91,062. Divided and this application July 14, 1937, Serial No. 153,499.
In France July 17, 1935
6 Claims. (Cl. 60—32)

1. In an internal combustion engine, the combination of exhaust means, having an opening of conventional cross section, at least one tube element directly connected with said exhaust means, said tube having a similar conventional cross section at its connection to said exhaust means and being gradually altered in form so as to be flattened and turned over upon itself in the form of a twisted band at the point



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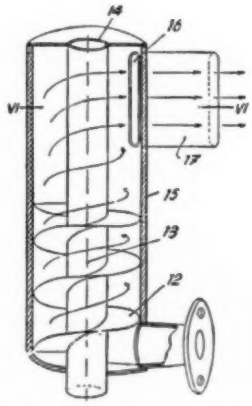
where the gaseous sheet rotating about itself assumes, in its portion flowing at high velocity and high pressure, a flattened or ribbon shape, said point being spaced a short distance exteriorly of said exhaust means, a tubular conduit of flat section directly prolonging said tube element and helically wound so as to accommodate and accentuate the gyratory motion of said gaseous sheet, whereby the latter undergoes a high centrifugal action, and outlet means for said tubular conduit extending tangentially thereto in a direction at right angles to the axis about which said conduit is helically wound.



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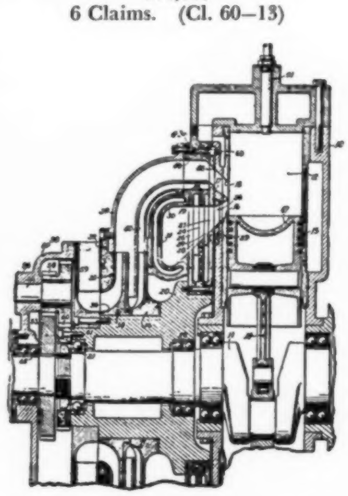
2,176,021
EXHAUST GAS TURBINE FOR COMBUSTION ENGINES
Fritz P. Grutzner, Beloit, Wis.
Application September 19, 1936, Serial No. 101,607
6 Claims. (Cl. 60—13)

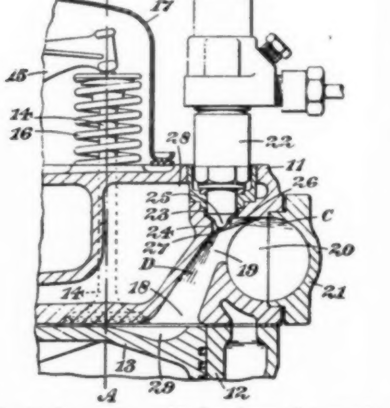


1. The combination with an internal combustion engine comprising a cylinder having a piston reciprocable therein and intake and exhaust ports in the walls thereof, said exhaust ports being disposed to be covered and uncovered by said piston, of a rotatably mounted combined turbine and exhaust port timing rotor, said rotor being provided with a segment of turbine blades and an elongated aperture disposed for successive registry with said exhaust port, and means for maintaining the rotation of said rotor in timed relation with the reciprocation of said piston to bring said blades and aperture each sequentially into registry with said exhaust port during the period it is uncovered by said piston.

2,169,381
INTERNAL COMBUSTION ENGINE OF THE COMPRESSION IGNITION TYPE

Charles Wallace Chapman, Peterborough, England, assignor to F. Perkins Limited, Peterborough, Northamptonshire, England, a British company.
Application November 17, 1937, Serial No. 174,959
In Great Britain December 17, 1936
4 Claims. (Cl. 123—32)

1. In a compression-ignition engine the combination of a working cylinder, a cylinder head, a combustion chamber approximating to a figure of revolution located in the side of the cylinder head, a transfer passage in the cylinder head affording communication between the combustion chamber and the working cylinder and extending from the end of the working cylinder towards the combustion chamber from a point to one side of the cylinder axis, said transfer passage being inclined away from the cylinder axis and bent outwardly in the course of its length intermediate its ends so that it enters the combustion chamber tangentially, a fuel nozzle projecting through the cylinder head and terminating at the outer side of the bend substantially flush with the wall of the transfer passage at the point of entrance, a recess in the wall of the transfer passage at the entry of the fuel nozzle thereinto such as to permit the tip of the fuel nozzle to be substantially flush with the general contour of the transfer passage and yet to inject part of the fuel along the transfer passage towards the engine cylinder and simultaneously to inject part of the fuel along the transfer passage tangentially into the combustion chamber and away from the cylinder, and a piston and operative connections to



expel air from the cylinder into the combustion chamber and transfer passage past the fuel injector on the compression stroke of the engine.

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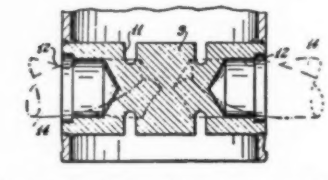
2,174,644
METHOD OF MAKING PISTONS
Albert J. Weatherhead, Jr., Cleveland, and Charles H. Crawley, Lakewood, Ohio, assignors to The Weatherhead Company, Cleveland, Ohio, a corporation of Ohio
Application February 15, 1937, Serial No. 125,760
11 Claims. (Cl. 29—156-5)

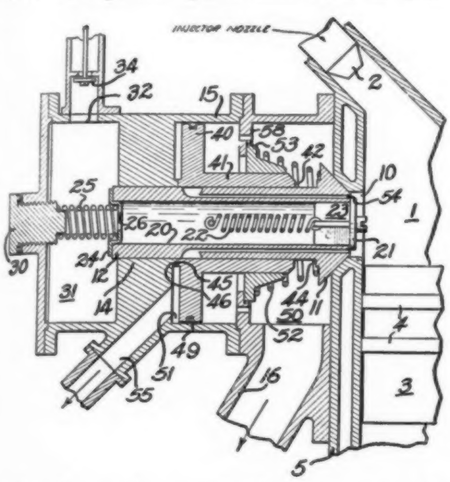


1. That method of making a piston which comprises forming a cylindrical skirt portion of ferrous metal, forming diametrically opposed apertures in said skirt portion, supporting a unitary pin boss forming slug is said opposed apertures, brazing said slug to said skirt in said apertures and thereafter drilling said slug axially and removing the central portion thereof to provide a pair of spaced aligned wrist pin bosses.

2,173,857
CONTROL VALVE AND CONVERTING SYSTEM
John Phillips, Oakland, Calif.
Application September 22, 1937, Serial No. 165,119
8 Claims. (Cl. 60—16)

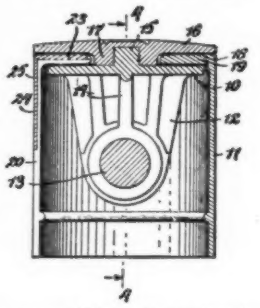
1. An air control mechanism for an internal combustion engine having a ported combustion chamber, comprising a valve adapted to form a tight seal with said ported chamber, a cylindrical valve body extending from said valve, a closed cylinder concentric with said valve body and forming a piston chamber therearound, a piston free to move within said chamber and bearing against both said valve body and the inner wall of said piston chamber, the area of said piston being greater than the area of said valve exposed to said combustion chamber, an air source, and means

for controlling air pressure from said source in said piston chamber back of said piston to force said piston against said valve to lock



said valve against combustion pressures and to return said piston to an unlocking position.

2,174,417
PISTON
Leon A. Hallstead, Grand Island, N. Y.
Application November 16, 1938, Serial No. 240-832
4 Claims. (Cl. 309—15)



1. A piston, comprising a lower head section, an upper head section, screw means connecting said head sections, said head sections when tightly connected providing between them an annular, peripheral groove of substantial depth which is closed at its inner end, a skirt fitting around said head and having an inwardly projecting annular flange slidingly and closely fitted in said groove, and a pin extending through one head section and skirt and into the other head section and restricting relative movement of said head and skirt and also preventing said head sections from unscrewing.

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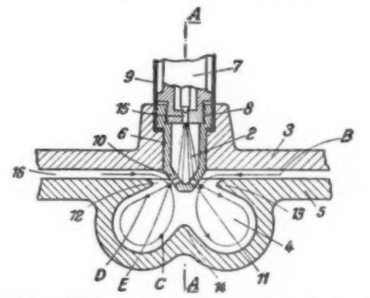
2,171,912
INTERNAL COMBUSTION ENGINE
Walter Boxan, Chemnitz, Germany, assignor to Auto Union Aktiengesellschaft, Chemnitz, Germany
Application May 3, 1937, Serial No. 140,558
In Germany May 5, 1936
5 Claims. (Cl. 123—33)

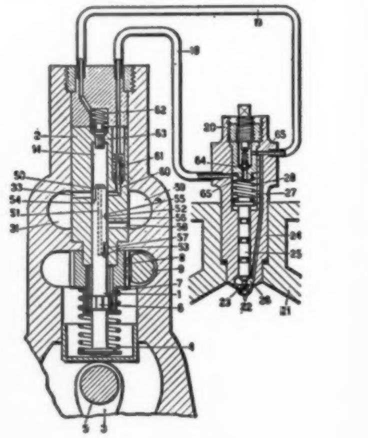
1. An internal combustion engine of the air compressing, self-ignition and pressure injection type for liquid fuels, comprising in combination with a cylinder and a reciprocating piston, an annular cavity of substantially round cross section formed in one of said members and having an annular opening communicating with the cylinder space above the piston to form an eddy current confining chamber for the air com-



pressed by the compression stroke of the piston, a fuel injection valve, and a precombustion chamber arranged between the fuel injection valve and the eddy chamber and provided with throttle openings through which a fuel gas mixture is injected into the annular eddy cavity, said openings being inclined at an angle to the outer portion of the circular wall of the cavity to produce substantially a tangential introduction of the mixture into the cavity, said fuel mixture being constrained to move inwardly in countercurrent to the outward constrained movement of the compressed air in the eddy chamber, the fuel mixture from the precombustion chamber and the countercurrent compressed air circulating in the eddy chamber serving to intimately commingle the air and gas mixture within said eddy chamber.

2,173,812
FUEL INJECTION APPARATUS
Bernhard Bischof, Winterthur, Switzerland
Application August 31, 1937, Serial No. 161,850
In Switzerland September 9, 1936
7 Claims. (Cl. 123—139)

1. The combination of a fuel injection device including a housing provided with a passage through which fuel is supplied to an injection nozzle, a fuel valve controlling flow through said passage, means connected with said fuel valve and acting thereon in an opening direction under the pressure of supplied fuel, a loading chamber in which fuel under pressure may act in a valve closing direction, a relief valve permitting flow from said chamber to said passage, and means biasing said fuel valve in a closing direction; a pump comprising a cylinder and a piston, said pump having a discharge connection leading to the supply passage of said injection device and a loading connection leading to the loading chamber of said fuel valve and including a loading port controlled by the piston of said pump; and a one-way flow valve in the last-named connection for permitting flow toward said loading chamber; the cylinder having an unloading port and the piston having ports which selectively connect the working space of the pump with said loading port and with said unloading port, the parts being so arranged that as the piston moves in displacing direction it displaces fuel through said discharge connection, then connects the working space of the pump with said loading connection, and then interrupts the last-named connection and establishes a connection from the working space of the pump to said unloading port.



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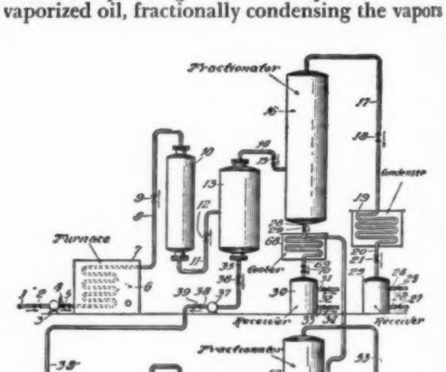
2,176,353
MANUFACTURE OF AUTOMOTIVE FUEL
Jacque C. Morrell, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill., a corporation of Delaware
Application July 30, 1936, Serial No. 93,372
2 Claims. (Cl. 196—49)

1. A process for producing Diesel engine fuel and fuel for spark ignition engines from paraffinic and mixed base residues heavier than gas oil, which comprises, subjecting such residue to a temperature of from about 950 to 1100° F. for a cracking time of the order of less than five seconds, separating resultant vapors from unvaporized oil, fractionally condensing the vapors



to form a condensate of hydrocarbons heavier than gasoline and removing this condensate from the process, subjecting said unvaporized oil to a temperature of from about 850 to 950° F. for a time period ranging from about 10 to 40 seconds to convert a substantial portion thereof into gasoline, fractionating the vapors formed by the last-named cracking treatment to condense fractions thereof heavier than gasoline, and finally condensing and collecting the fractionated vapors.

Bauer Named General Sales Manager for Witte Engine Works

MR. ED H. WITTE, President of the Witte Engine Works, Kansas City, Missouri, has just announced the appointment of Frank K. Bauer as General Sales Manager and company Secretary effective August 16, 1940.

Frank Bauer comes well qualified to head up the Witte sales force and was chosen by the company as a result of his successful sales record with the National Battery Company. He served with the latter organization for the past seventeen years, starting out as a cub salesman in Kansas City. He was promoted to District Sales Manager in 1927, Kansas City Division Sales Manager in 1933, and General Sales Manager at Saint Paul general offices in 1937. During this period, he supervised light plant generator and battery sales as well as directed automotive battery sales from their nine factories.

The recent development of small Dieselectric plants by the Witte Engine Works, which are particularly adapted to handle the power and light requirements of super service stations, garages, tourist camps and resorts, hatcheries, locker plants, and small factories, has opened up a new and broad field. In heading up the Witte sales force, Bauer plans to bring about a substantial increase in the number of representatives and distributors to serve this tremendous field.

CODRINGTON SPEAKS

Construction of two additions to present buildings by the Cleveland Diesel Engine Division of General Motors Corporation, 2160 West 106th Street, Cleveland, Ohio, will be started soon to provide room for increased production made necessary by recent orders and the prospect of continued steady volume on a higher level than heretofore, George W. Codrington, General Manager, announced.

The additions will total 37,650 square feet of floor space. One wing, 100 x 240 feet, will be added to the present test building and another 65 x 210 feet will go on the present assembly building. The additions will be of the same steel and glass design as the present structures.

The Division not only has on hand a large volume of orders for Diesel engines and other marine propulsion equipment from the U. S. Navy but acceptance of the GM version of Diesel-electric drive for commercial vessels of all sizes and types is rapidly increasing, George Codrington said.

The Division has developed a highly effective type of marine Diesel-electric drive, now used on dozens of ships on both Coasts, the Great Lakes and other inland waterways.

LION NATURALUBE OILS

THE Lion Oil Refinery at Eldorado, Arkansas, announces they have appointed General Lubricants, Inc., with offices at 514 West 57th Street, New York City, as their distributors of Naturalube oils and greases in Eastern Pennsylvania, New Jersey, New York, and all New England States.

This is the first entry the Lion Company has made in the eastern market, although they are very successful in the marketing of their products in the Middle West and the South. The many inquiries they have had from the eastern territory regarding Naturalube is responsible for their decision to make these products available through General Lubricants, Inc.

Naturalube oils and greases are the products from crude oil found in the southwestern corner of Arkansas in the Smackover Field. Due to the base crude from which it is produced, many unusual properties are claimed for this lubricant including solvent and penetrative properties and very high film strength.

NEW DIESEL ENGINE CATALOG

JUST off the press, the DIESEL ENGINE CATALOG, Volume V, is now ready to mail. 320 pages, size 10¼ in. by 13½ in., 820 illustrations. Edited by Rex W. Wadman. Price $3.00 postpaid.

One hundred twenty-four different models of Diesel engines are described in full detail in this new book, seventeen more than in Volume IV published last year.

This new book on Diesel engines is entirely different from any other book published on the subject. It describes and illustrates in intimate detail ALL engines now available on the American market, as such it is tremendously useful from many different angles.

Beautifully illustrated in color, with sectional drawings visualizing with complete clarity the design features of each engine, this new book brings you under one cover a marvelously clear picture of the engines now available. Right up to the minute, as modern as tomorrow, printed on a big page size (10¼ in. by 13½ in.) to make the illustrations readable, this new book is indispensable to the Consulting Engineer, Diesel Salesman, prospective Diesel engine buyer—yet the price is but $3.00 postpaid.

We offer you this new book, believing it to be the finest book of its type ever produced, au-

thoritative, informative, beautifully printed and bound — a book you will be proud to own, a book from which you will obtain much useful information.

Copies of the DIESEL ENGINE CATALOG, Volume V, may be obtained from Diesel Engines, Inc., 2 West 45th Street, New York, N. Y. Price $3.00 postpaid.

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NOVEL TEST OF FARREL GEAR DRIVES FOR FIVE C-1 SHIPS

Few manufacturing plants have facilities on a test block for absorbing over 4000 shp. at 90 rpm., which was the problem faced recently by the engineers of Farrel-Birmingham Company, Inc., Buffalo, N. Y. Although marine reduction gear drives of this size for use with Diesel engines have seldom before been factory tested prior to shipment, Farrel officials insisted upon a week's trial for each at full rated load before five main propulsion gear sets of 4150 shp. were delivered to the U. S. Maritime Commission C-1 ships now building at the Western Pipe & Steel Company at San Francisco. The ingenious method of applying this load to conduct the tests is of unusual interest.

As the accompanying illustration indicates, the gear units were tested in pairs and the load was applied as follows: The far pinions were connected by a short length of high tensile strength steel shaft capable of torsional distortion without breaking or losing its elasticity. Two halves of a rigid coupling fitted with large hexagonal

sections were bolted to the near pinion shafts. After computing gear tooth pressure under full load conditions this pressure was transmitted to the gear teeth by holding one half of the coupling stationary and turning the other half by means of a large wrench correctly weight-loaded. When the desired tooth pressure was attained the two halves of the coupling were bolted together and full load conditions then maintained within the two gear cases. The electric motor at the lower left-hand corner of the picture maintained operating speed of the units once they were in rotation. Although full power of over 4000 shp. was not actually transmitted by the gears, an equivalent load in the form of gear tooth pressure simulated actual service operating conditions and assured the builders that each unit was completely satisfactory for shipment and installation.

In service, each pinion will be connected to a 7-cylinder, 2-cycle, Busch-Sulzer Diesel rated at 2160 bhp. at 233 rpm. for normal continuous duty and will transmit this power through the bull gear to a single propeller at 90 rpm. Elliott electro-magnetic couplings will be installed between engines and pinion shafts to absorb torsional vibration and protect the engines against possible shock from propeller fouling or striking an obstruction. The electric coupling is carried on its own shaft, which passes through the pinion and revolves in its own bearings. The pinion also revolves in its own individual bearings, and is connected to the coupling drive shaft through the medium of a flexible coupling. This arrangement permits the pinion to align itself without interference from the weight load of the coupling.

The Farrel gear units measure approximately 20 feet overall athwartship and, so far as is known, these tests are the most ambitious ever successfully completed by any gear manufacturer.

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NEW BOOKLET DESCRIBES MODERN METHODS OF SCALE AND RUST REMOVAL

OF special interest to municipalities, utilities, truck and bus fleet owners, railroads, dairy plants, industrial power users, and other Diesel operators interested in safe, modern methods of removing water scale and other deposits from cooling jackets of Diesel engines, is a new twenty-page, illustrated booklet just issued by Oakite Products, Inc.

The booklet describes a recently developed material, Oakite Compound No. 32, and tells how it makes possible the safe, effective descaling of many other different types of water-cooled equipment, such as surface condensers, mechanical refrigerating equipment, vertical open-type condensers, and compressors, without the need of expensive, time-consuming mechanical methods often previously resorted to in handling maintenance work of this nature.

Copies of this interesting, fact-filled booklet are available upon request. Write to Oakite Products, Inc., 22D Thames Street, New York, N. Y.